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METALS and ALLOYS

The Magazine of Metallurgical Engineering

PRODUCTION • FABRICATION • TREATMENT • APPLICATION

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Highlights

WRITTEN BY THE ABSTRACT SECTION EDITORS AND THE EDITORIAL STAFF

Do you want to know what metallurgical engineers are saying, the world over? Look in the Current Metallurgical Abstracts. Here are some of the points covered by authors whose articles are abstracted in this issue.

Accuracy?

A treatment that raises elongation of a cast Al alloy from 4.5 to 7.5 per cent is interesting, but the pseudo-accuracy with which these elongations are reported as 4.53 and 7.64 per cent is not so enviable, since the second place of decimals is meaningless (page MA 202L2).—H.W.G.

Light Alloys

Sachs and Scheuer (page MA 202R3) comment on the ability of a heat-treatable high Si Al-Si alloy to be water quenched without cracking, while de Fleury and Portier (page MA 202R6) point out industrial consequences of the low modulus of elasticity.—H.W.G.

Desulphurizing Pig Iron

Instead of using a basic slag in the blast furnace to remove S, Paschke and Peetz (page MA 204L7) advocate operating acid and even using high-S coke, then desulphurizing the melt in a separate container, somewhat as in cupola practice.—H.W.G.

Zirconium and Gas

We are accustomed to the idea that Ta has great capacity to absorb some gases. Metallic Zr is less common, but de Boer and co-workers (page MA 226R3, 5, 7) find a somewhat similar phenomenon with it.—H.W.G.

Supersonics

Seeman (page MA 226R2) suggests supersonic waves for making alloy mixtures like Cu-Pb, degasing and removal of inclusions. What a paradise for the ad-writer if and when this becomes commercial.—H.W.G.

Corrosion

Pulling dissolved air out of 4 million gallons of water daily, to prevent corrosion, as described by Powell and Burns (page MA 234R1) is quite a sizeable operation.—H.W.G.

Blast Furnace Slags

Colclough (page MA 201R6) gives some real information—the proper analysis of blast furnace slags for smooth working of the furnace.—C.H.H.

Headlines

Roncerey (page MA 232R2, 4, 6, 8 and MA 234L6, 8) believes in putting much of his story in the titles of his articles, and is trying to widen the nomenclature of corrosion, e.g. "antagonisms and alliances between the effervescent and silent types of corrosion."—H.W.G.

Atmospheric Corrosion vs. Coal Leachings

According to Schramme and co-workers (page MA 232R10) the corrosion of open top coal cars isn't primarily from the leachings from the pyrite in the coal, but from the atmosphere.—H.W.G.

Patents on Phosphate Treatments

The international patent situation relative to rust-proofing by phosphate surface treatments is reviewed in two recent articles, one by Macchia (page MA 222R7) in Italian, and the other by Justh (page MA 222R8) in German.—F.P.P.

Corrosion in the Sugar Industry

Some interesting reports of corrosion problems in the sugar industry are given in four articles (page MA 234R3, 4). Brass seems to be the fair-haired boy here, although Si-Fe and P-bronze are also recommended.—F.P.P.

Tantalum

Genders and Harrison's discussion of Ta as an alloying metal in iron and steel (page MA 230L1) indicates it to be of negligible value in this respect. On the other hand pure Ta, by virtue of its corrosion resistance, finds many commercial applications, which are described by *Product Engineering* (page MA 236L2) and Guzzoni (page MA 236L5).—F.P.P.

Self-Sharpening Hard-Faced Blades

One of the outstanding advantages of hard-facing is that the hard metal may be applied to a cutting blade so as to make it self-sharpening in service. To accomplish this, the hard-facing material is welded along the top surface of the blade only. The bottom surface of the blade, coming in contact with the work, is left unfaced or plain. In service, this softer metal on the bottom surface or heel of the blade naturally wears away first, thus maintaining a sharp cutting edge at the top hard-faced surface of blade.

Hard-facing, applied in this manner, is widely used for dredge cutter blades, road grader blades, scarifier teeth, drag line bucket teeth and similar equipment. The overall expense of using self-sharpening hard-faced blades is only a fraction of that of unfaced or plain steel blades. As ordinary blades become dull, operations are slowed down; output and efficiency of equipment are decreased; frequently more power is required to drive the machine in order to maintain satisfactory performance. For example, one Western contractor saved 10 to 15 per cent in power consumption because his hard-faced ditcher teeth stayed sharp. Unprotected teeth quickly became dull and were correspondingly harder to pull. Moreover, the dull teeth were inefficient and placed undue strain on the entire equipment (page MA 216R6).—E.V.D.

Rail End Welding

The first all-iron rail used in the United States was on the Camden-Amboy Railroad in 1848. It proved a great disappointment, however, as it battered very badly at the ends. This, in turn, caused considerable shock and damage to the rolling stock and discomfort to the passengers. After only a few months' service the all-iron rail had to be removed and replaced with the old iron-topped wooden rail previously employed. This was the first instance of rail end batter in this country—a problem which in those days necessitated removal of the rail but nowadays is solved very satisfactorily and economically by welding or reforming.

When rail ends begin to batter and go down, maintenance expense goes up. There is excessive wear in bolts and angle bars, loose joints, shattered ties and rough riding track. Even the ballast is dislodged by the hammering of the engine and car wheels as they pass over the battered joints. Section men must pay frequent attention to such joints. Bolts must be tightened, joint bars renewed, if badly worn or broken, and the joint tamped up. Otherwise worse conditions, such as wide gage and poor line, may occur.

To illustrate the saving secured by rail end welding, suppose a badly battered joint has developed in 130-lb. rail. A rail of this weight in place in the track is worth approximately $35. Without welding, it would be necessary to replace the two rails whose ends were battered at the joint. This would involve transporting two new rails to the location and returning two defective rails removed. Besides the labor of removing battered rails and replacing them in the track, probably a new pair of joint bars and some new bolts and spikes would be required. In addition to the section men, signal men probably would have to be on hand to bond the three joints affected. A total expenditure of at least $50 would be incurred, even after allowing credit for scrap value of battered rails.

By welding with the proper rod, the battered joint is built up for approximately $1 and is better than new, because the welding rod now used for this class of work produces a better wearing joint than new rail. Today, the practice of rail end welding and building up frogs and switch-points is standard on practically every railroad in this country. The enormous savings and other benefits obtained by the railroads from the use of welding in maintenance-of-way work are evident from the above simple example (page MA 216R7).—E.V.D.

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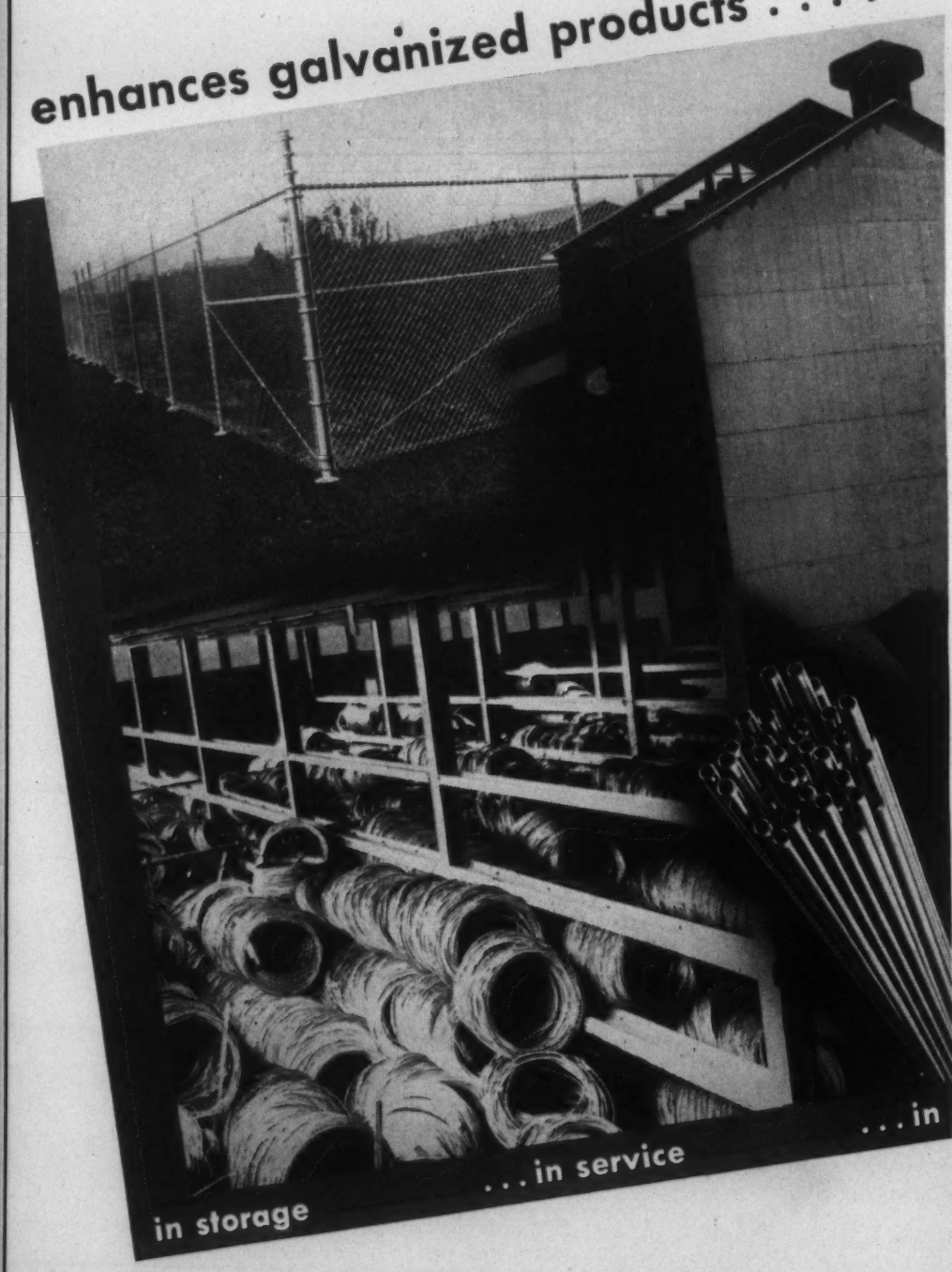

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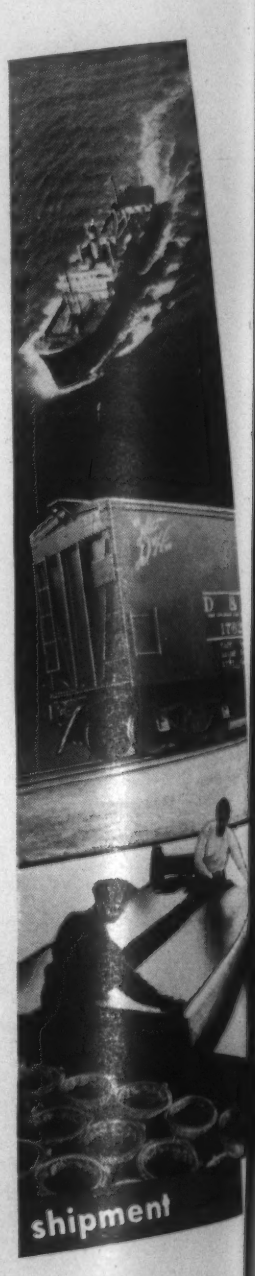

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EDITORIAL

What Is This New Metallurgy?

A singular, nebulous condition seems to prevail at the present time in regard to What is Metallurgy and as to the manner the subject should be taught; and this has descended upon us with little warning and seems to come from nowhere in particular. Nevertheless it has permeated the very air we breathe where metallurgical education is discussed.

We hear a great deal about physical metallurgy and the physics of metals. Before discussing the possible meaning of these terms, it will not be out of place to recall their origin.

At the Engineering Congress held in Chicago in 1893 three papers were presented dealing with the microstructure of steel, a subject at the time relatively new, by Osmond of France, Martens of Germany, and myself. These contributions were extensively discussed and the discussion continued in subsequent years under the title of "Physics of Steel." In 1901 a course was established in Harvard University, designated as "The Physics of Metals."

Physical metallurgy, we are told, should be taught rather than metallurgy but no one, so far as I know, has yet told us in which way physical metallurgy differs from metallurgy. Does it signify that we should devote more attention to the physical side of metallurgy? Does it mean that physical metallurgy should be restricted to the study of the properties of metals and alloys, while ignoring the methods by which they have been obtained? Surely metallurgists have never considered that their duties were achieved after they had produced the metals. They have always been vitally concerned with their properties and behavior and have probably devoted more time and labor to that phase of the subject than to the extraction processes.

Have not metallurgists always realized that metallurgy was essentially applied chemistry and applied physics? Have they not always welcomed the contributions of chemists and physicists? It cannot be claimed that they have failed to realize the possibilities of X-ray diffraction analysis, for instance. Indeed, in my opinion, they have if anything exaggerated these possibilities. When the phase rule was enunciated, they fell head over heels in their attempts to apply it to metallurgical problems. Indeed, restraint rather than urging seems to be in order when it comes to the use by metallurgists of new tools and theories.

Some appear to hold that metallurgists, physical metallurgists at least, need not familiarize themselves with such crude operations as those concerned with the extraction and refining of metals! A singular point of view as, after all, the art has its importance. These operations, moreover, are chock full of chemistry and physics.

It is gratifying to note that physicists are manifesting a desire to help metallurgists but, lest we prepare the way for disappointment, let us abstain from sharing the claims of some that they have broken or are about to break into virgin fields. They will find, I believe, that for the most part, these fields have already been trodden by the clumsy feet of metallurgists.

Metallurgists welcome the cooperation of physicists, be they ever so pure, in solving their problems. They believe, however, that their attempt at educating the other fellow should work both ways and that modesty on both sides is in order, and also understanding and appreciation for each other's achievements.—ALBERT SAUVEUR

Progress in Gray Iron

We all realize the rapid strides that have been made in the metallurgy of cast iron in the last 15 years. There has been in consequence an improvement of its properties as well as renewed acceptance of it for engineering purposes. But the details of the metallurgical, heat-treating, and alloying developments as well as those in engineering applications are manifold—not possible of cataloging in a brief space of time.

To take only one or two instances—before the war the best quality of gray iron had a tensile strength of only about 15,000 to 20,000 pounds per square inch. Today gray iron is made in quantity with tensile values from 40,000 to 60,000 pounds. As high as 70,000 to 80,000 pounds can be attained.

Before the war little alloy gray iron was produced. In 1936 about 10,000 tons of alloys were used to yield over 1,000,000 tons of alloy iron castings. With the 1936 output of gray iron put at 10,000,000 tons, already about 10 per cent is alloyed iron.

These facts are from the Howe Memorial Lecture for 1937 as delivered by Dr. Paul D. Merica in February at the annual meeting of the Mining Engineers. For a complete and authoritative analysis of the status of gray iron today, we recommend the careful reading of this valuable and masterly presentation entitled "Progress in the Improvement of Cast Iron and the Use of Alloys."—E. F. C.

Scrap Exports a Problem

Prices for scrap iron and steel have reached heights that surpass those of any year in the last ten. Exports of scrap have been heavier in the last three years than ever before in our history. These exports, together with the return of near-normal prosperity in this country, are the combined cause of the soaring market. As high as $21 per ton, Atlantic ports, has been paid for export and $25 is freely predicted. Not since 1926 has anything approaching $21 been paid for domestic or foreign use.

Only in the last three or four years has the foreign demand for scrap—largely from Japan and Italy—been serious as to tonnage. In 1934, 1935 and 1936 there has been exported from the United States over 5,980,500 gross tons of scrap iron and steel, including tin plate scrap. These are the official data. The largest total was in 1935 at 2,103,959 tons with 1936 only about 163,000 tons less. In the seven years previous to 1934, when the large exports

(Continued on page 97)

5 REASONS why their Choice is SUPEREX!

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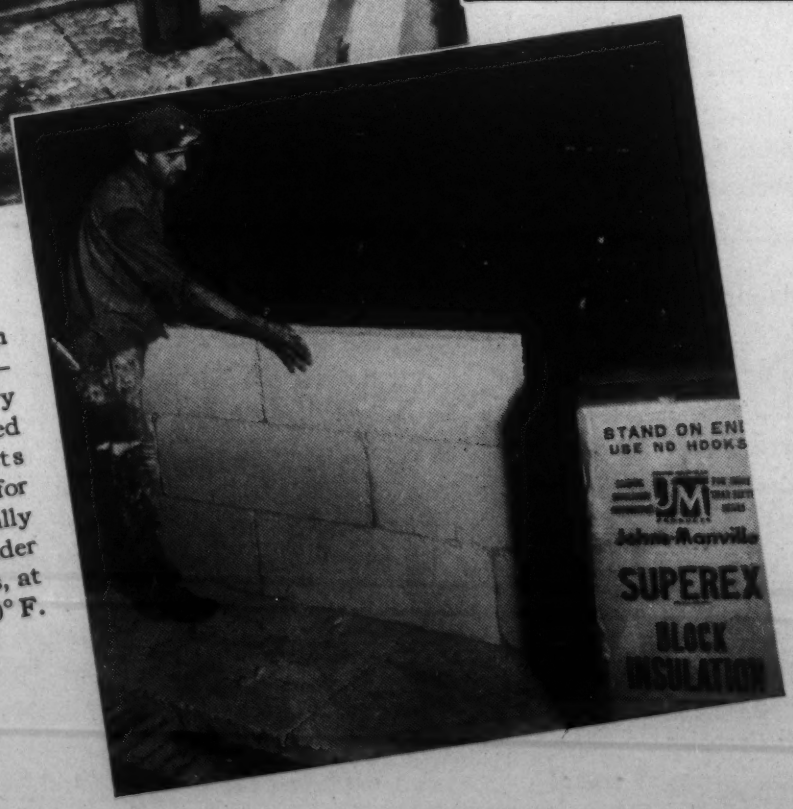

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Johns-Manville INDUSTRIAL INSULATIONS

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CURRENT Metallurgical Abstracts

A DIGEST OF THE IMPORTANT METALLURGICAL DEVELOPMENTS OF THE WORLD

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CLASSIFICATIONS

1. ORE CONCENTRATION

Crushing, Grinding & Plant Handling (1a), Gravity Concentration (1b), Flotation (1c). Magnetic Separation (1d), Amalgamation, Cyanidation & Leaching (1e).

2. ORE REDUCTION

Non-Ferrous (2a), Ferrous (2b).

3. MELTING, REFINING AND CASTING

Non-Ferrous (3a), Ferrous (3b).

4. WORKING

Rolling (4a), Forging & Extruding (4b), Cold Working, including Shearing, Punching Drawing & Stamping (4c), Machining (4d).

5. HEAT TREATMENT

Annealing (5a), Hardening, Quenching & Drawing (5b), Aging (5c), Malleableizing (5d), Carburizing (5e), Nitriding (5f).

6. FURNACES, REFRACTORIES AND FUELS

7. JOINING

Soldering & Brazing (7a), Welding & Cutting (7b), Riveting (7c).

8. FINISHING

Pickling (8a), Cleaning, including Sand Blasting (8b), Polishing & Grinding (8c), Electroplating (8d), Metallic Coatings other than Electroplating (8e), Non-Metallic Coatings (8f).

9. TESTING

Inspection & Defects, including X-Ray Inspection (9a), Physical & Mechanical Testing (9b), Fatigue Testing (9c), Magnetic Testing (9d), Spectrography (9e).

10. METALLOGRAPHY

11. PROPERTIES OF METALS AND ALLOYS

Non-Ferrous (11a), Ferrous (11b).

12. EFFECT OF TEMPERATURE ON METALS AND ALLOYS

13. CORROSION AND WEAR

14. APPLICATION OF METALS AND ALLOYS

Non-Ferrous (14a), Ferrous (14b).

15. GENERAL

Economic (15a), Historical (15b).

1. ORE CONCENTRATION

JOHN ATTWOOD, SECTION EDITOR

Washing Deep Lead Gravels for Gold. L. A. CROZIER. *Chemical Engineering & Mining Review,* Vol. 29, Nov. 9, 1936, pages 43-45. At Allandale, Vic., re-treating of gravel dumps from deep Pb operations by washing and gravity collection is practiced. In Au recovery from this wash, the material is puddled with water to free the coarse and fine stones embedded in sand. The stones are removed by forking and the sand and fine gravel, as a pulp, passes down sluice boxes for the collection of the Au. 15 oz. Au are obtained weekly from 3,000 yds.^{3} WHB (1)

Concentration Tests with Manganese Ores of Urkut (Aufbereitungsversuche mit Manganerzen von Urkut) J. FINKEY. *Royal Hungarian Palatine-Joseph University of Technical & Economic Sciences, Faculty of Mining, Metallurgy and Forestry of Sopron,* Vol. 8, 1936, pages 70-85. Concentration of the very clayish ore of 20-40% Mn was studied. A concentration up to 40-45% with a yield of 60-70% of metal could be obtained by washing the ores. Ha (1)

Emperor Ore Treatment. *Chemical Engineering & Mining Review,* Vol. 29, Nov. 9, 1936, pages 49-50. Metallurgical results at the Emperor mine at Tavua, Fiji have improved markedly. During Aug. 1936, 2315 tons of ore were treated with extraction of 91.3%, one feed assaying 10 dwt. per ton. A new mill for the treatment of 12,000 tons of oxidized ore monthly has been designed. Treatment and type of equipment are listed. WHB (1)

Ore Dressing Research—Results of Tests at C. S. I. R. Laboratories. *Chemical Engineering & Mining Review,* Vol. 29, Nov. 9, 1936, pages 55-62. A series of outlined reports on operations at the following mines: Misima ore, Papua, Ltd.; Eldorado mines, Tennant Creek, Central Australia; Thomas' find, Cave Rocks, W. A.; weathered ore from Youanmi W. A.; ore from Flagstaff Au mine, Coolgardie, W. A.; ore from Ravensthorpe, W. A.; arsenical Au ore from Auburn Falls, Queensland; tailings from the Magdala mine, Stawell, Vic.; and auriferous sulfide ore from the Mt. Firebrace, Granya, Vic. In each case operations are summarized and conclusions drawn. WHB (1)

Ore Mining by the Gutehoffnungshütte in Southwestern Germany (Der Eisenerzbergbau der Gutehoffnungshütte in Südwestdeutschland) R. NAUMANN. *Mitteilungen aus den Forschungsanstalten des GHH-Konzerns,* Vol. 4, Oct. 1936, pages 187-197. Ore treated at this new mine contains 13-22% Fe, the yield of Fe being 62-65%. Average analysis of ore is 22% Fe, 0.2% Mn, 0.4% P, 21.8% SiO_2, 0.08% V, 11.8% CaO, 2.24% MgO, 9.2% Al_2O_3, 0.99% TiO_2, 0.5% S. Concentration methods are described. Ha (1)

Geology of Siscoe Gold Mine. O. L. BACKMAN. *Canadian Mining Journal,* Vol. 57, Oct. 1936, pages 467-475. The Siscoe ore deposits consist of quartz veins occurring chiefly in an intrusive granodiorite and in Keewatin greenstones. The Au is mostly free and in fractures in the quartz, though some Au accompanies sulphides such as chalcopyrite, pyrite and pyrrhotite. WHB (1)

Little Long Lac Gold Area—Scene of Promising Activity. A. H. HUBBELL. *Engineering & Mining Journal,* Vol. 137, Nov. 1936, pages 571-574. Recent finds in this northwestern Ontario district strengthen its position. Mill operations include cyanidation, amalgamation and flotation together with the use of blankets and roasting. A detailed flowsheet is included. WHB (1)

Mining at Lamaque Gold Mine. J. C. PERRY. *Canadian Mining Journal,* Vol. 57, Oct. 1936, pages 517-523. WHB (1)

Milling at Shawkey Gold Mines, Ltd. W. A. MCKINLEY. *Canadian Mining Journal,* Vol. 57, Oct. 1936, pages 546-548 WHB (1)

The Time Element in Gold Mine Development. W. F. BOERICKE. *Canadian Mining Journal,* Vol. 57, Dec. 1936, pages 639-642. WHB (1)

Granby in Retrospect—A Look Backward to the Mining Problems That Confronted the Company and the Contributions Made to the Industry in Solving Them. C. M. CAMPBELL. *Engineering & Mining Journal,* Vol. 137, Dec. 1936, pages 616-618. WHB (1)

1a. Crushing, Grinding & Plant Handling

2 **Dry Grinding—Experience in British Columbia.** A. W. HOLLOWAY. *Canadian Mining Journal,* Vol. 58, Jan. 1937, pages 8-10. WHB (1a)

1c. Flotation

3 **Selective Flotation of Mercury and Antimony Ores.** F. N. BELASH. *Redkie Metallui,* Vol. 5, May-June, 1936, pages 23-31. In Russian. Table concentrates containing 12% HgS and 5.20% Sb_2S_3 were floated using 100 g. pine oil and 180 g. ethyl xanthate per ton. Na_2S, CaO, $Na_2S_2O_3$, $K_2Cr_2O_7$, and para-amidophenol were used to depress the Sb_2S_3. Reflotation of the tailings in an acid solution with Aerofloat recovered 60% of the Sb in a concentrate containing 17.5% Sb. The Hg concentrate contained 73% HgS with a recovery of 90%. HWR (1c)

4 **The Physical Chemistry of Flotation. VII. Trimethylcetylammonium Bromide as Flotation Agent.** IAN WILLIAM WARK. *Journal of Physical Chemistry,* Vol. 40, May 1936, pages 661-668. Solutions of trimethylcetylammonium bromide possess to an unusual extent, certain properties that influence the flotation of minerals. The compound is one of the best frothing agents known, even a 10 mg./liter solution giving a very stable froth. 5 From aqueous solutions the salt is absorbed by a wide variety of minerals, and since it possesses the polar-nonpolar structure characteristic of collectors, it is almost a universal flotation reagent of the collector class. Dilute solutions induce flotation of chalcopyrite, pyrite, sphalerite, galena, and other sulphide minerals. Several silicate minerals also respond to it. Detailed information is given on depressants, induction period for contact between air and mineral, contact at a paraffin surface, surface tension measurements (2 diagrams) and frothing. (See also *Metals and Alloys,* 6 Vol. 3, page MA 337 L1; Vol. 4, page MA 373 L6; Vol. 5, pages MA 114 L5, MA 114 L6; Vol. 6, page MA 433 L6; Vol. 7, pages MA 225 R3, MA 338 L5.) WH (1c)

7 **The Physical Chemistry of Flotation. VIII. The Process of Activation.** ELSIE EVELYN WARK & IAN WILLIAM WARK. *Journal of Physical Chemistry,* Vol. 40, June 1936, pages 799-810. It has been found that salts of the metals Pt, Au, Bi, Hg, Ag, Cu, Cd, Pb, Ce, Sb, and As "activate" sphalerite in such a manner that it responds to ethyl xanthate and floats readily. Tl and Co induce a somewhat weaker response and Ti is not a sufficiently powerful activator to cause flotation. In general, the metals that are effective as activators form relatively insoluble sulphides and those that are not effective form relatively soluble sulphides. It is not possible to decide whether solubility considerations alone govern the activation process. Tl, whose sulphide is reputed to be more soluble than that of Zn, does activate sphalerite, and Sn 8 salts, which give less soluble sulphides, do not activate sphalerite. However, the reported solubility products are not to be relied upon. WH (1c)

Development of the Air-float Method of Gravity Separation. R. R. SLAYMAKER. *Transactions American Society of Mechanical Engineers,* Vol. 58, Aug. 1936, pages 443-453. History of development of air-float or pneumatic type of gravity separator for ores, coke, coal, and other commodities is reviewed; the principle 9 is based on the fact that when particles of approximately the same size but of varying densities are fed over a porous table through which air is blown at a velocity such that the lightest particles are held at the point of suspension, there is a tendency to stratify the mass. Some types of separators are described. Ha (1c)

Selective Flotation of Mercury and Antimony Ores. S. P. ALEKSANDROV & A. A. BOLDUIREV. *Redkie Metallui,* Vol. 5, 10 Mar.-Apr. 1936, pages 35-36. In Russian. $K_2Cr_2O_7$ and H_2SO_4 which were used to depress the Sb_2S_3, also depress the HgS somewhat. No good activator for the depressed Sb was found. HWR (1c)

Outline of the Theory of Flotation (Grundriss der Theorie des Flotationsverfahrens) J. FINKEY. *Royal Hungarian Palatine-Joseph University of Technical and Economic Sciences, Faculty of Mining, Metallurgy and Forestry of Sopron,* Vol. 8, 1936, pages 86-101. The functions of the frothing agent and its required properties are explained, especially the importance of the surface tension of the liquid with respect to the floating material.
Ha (1c)

Zinc Flotation at Riddr (Russia). S. P. ALEXSANDROV & O. N. LOZHNIKOVA. *Tzvetnuie Metallui,* No. 7, Aug. 1936, pages 48-67. Description of experimental work conducted at Ridder for the purpose of improving the efficiency of flotation of Zn-Pb ores.
BND (1c)

1d. Amalgamation

Separation of Hematite by Hysteretic Repulsion. E. W. SCHILLING & HARWICK JOHNSON. *Transactions American Institute of Mining & Metallurgical Engineers,* Vol. 120, *Iron & Steel Division,* 1936, pages 57-71. Includes discussion. See *Metals and Alloys,* Vol. 7, June 1936, page MA 278R/8. (1d)

1e. Amalgamation, Cyanidation & Leaching

Some of the Factors which Influence the Rates of Dissolution of Gold and Silver in Cyanide Solutions. ERNST BEYERS. *Journal Chemical Metallurgical & Mining Society South Africa,* Vol. 37, Aug. 1936, pages 37-89. Rate of dissolution of pure Au or pure Ag in dilute KCN solutions of constant O content increases as the cyanide strength increases from 0.01 to 0.20% Rate of dissolution of pure Au in dilute KCN solutions of constant concentration decreases as the dissolved O increases from 5.7 to 30 mg. O per 1.; rate for pure Ag increases as dissolved O increases from 5.5 to 26 mg. O per 1. Fe^{++} or Ni salts depress the rate of dissolution of pure Au. Pb, Cu salts or CaO are depressing in solutions below 0.08% KCN; Fe^{+++} or Zn salts below 0.13% KCN and $CaCl_2$ below 0.15% KCN. Hg or Mn salts are depressing above 0.08 and 0.05% KCN, respectively. Hg, Pb, ferrous, Mn, Ni, Cu, Zn salts or Ca compounds depress the rate of dissolution of pure Ag, but K ferricyanide improves the rate above 0.02% KCN. The electrode potential of pure Au or pure Ag in cyanide solutions of constant dissolved O content increases as cyanide increases from 0.01 to 0.20%; in solutions of constant KCN concentration, the electrode potential decreases as dissolved O increases from 4.5 to 28 mg. O per 1. Base metal impurities, except Pb and Hg salts, depress the flowing-solution electrode potential of pure Au in solutions of 0.01-0.20% KCN and constant O. Pb salts are depressants below 0.08% KCN, Hg salts only above 0.08% KCN; with pure Ag, all base metal impurities were depressing except in the higher cyanide concentrations where it is not always measurable. An apparent correlation exists between the rate of dissolution and the corresponding electrode potential (using flowing-solution electrode) of pure Au. This is apparent also when dissolved O is varied or when the cyanide solutions contain Hg, Pb or Fe^{++} salts. There is no such correlation for Ag, nor for either Ag or Au using stationary-solution electrode potentials. The rate of dissolution of pure Au in 0.01-0.20% KCN solutions saturated with air at 20° is controlled mainly by the rate of attack of the reagents up to 0.05% KCN and mainly by the rates of diffusion of the reagents and products above this point; for pure Ag, rates of diffusion control rates of dissolution. The rate of dissolution of 10% Ag-90% Au alloy in 0.01-0.20% KCN increases as dissolved O increases from 5 to 26 mg. O per 1. If pure Au is subjected to the action of dilute KCN solution containing a Pb salt, then cleaned in dilute HNO_3 and distilled H_2O and annealed, the Au is passive. The electrode potential of such passive Au does not reflect its rate of dissolution. If a mixture of O and N gases impinges on a Au disc in 0.05% KCN solution, the rate of Au dissolution increases as the O in the gas mixture is increased. The rate decreases as O increases when the gas does not impinge on the Au.
AHE (1e)

Teck-Hughes Mills 1000 Tons Per Day. EDWIN H. WHITMAN. *Engineering & Mining Journal,* Vol. 138, Jan. 1937, pages 7-12. A description of the cyanide plant with emphasis given to the mechanical details.
WHB (1e)

The Re-treatment of Cyanide Tailings from the Golden Horseshoe Mine. T. B. STEVENS. *Bulletin Institution Mining & Metallurgy,* No. 380, May 1936, pages 17-30; No. 384, Sept. 1936, pages 15-17. Discussion. See *Metals and Alloys,* Vol. 7, Oct. 1936, page MA 487R/9.
AHE (1e)

2. ORE REDUCTION

A. H. EMERY, SECTION EDITOR

2a. Non-Ferrous

Po-Shan Bauxite as a Possible Raw Material for the Production of Aluminum in China. SHOO-TZE LEO & WIE-CHENG WEI. *Journal of Chemical Engineering of China,* Vol. 3, June 1936, pages 113-123. Oxides prepared from Po-Shan bauxite according to method 2 of the Golden Sea Research Institute *(Journal Chinese Chem. Society,* Vol. 1, 1933, pages 120-128; Vol. 2, 1934, pages 354-364) should give 99% Al notched bars and pigs. The purity of the metal is almost proportional to the purity of the oxides. The Al obtained in laboratory experiments was always less pure than that produced on a commercial scale. Improvement of the method of preparing Al_2O_3 would result in a still better grade of Al.
EF (2a)

The Reduction of "Mixed-Tin" (Ueber Mischzinngewinnung) ARTUR GÖLDNER. *Chemiker Zeitung,* Vol. 60, June 17, 1936, pages 496-497. The history, modern production methods and technical uses of "Mischzinn" (54.4% Sn, 3.6% Sb and 41.9% Pb) are described.
FPP (2a)

2b. Ferrous

Investigations into the Influence of Coke Quality on Blast-furnace Operation. W. J. BROOKE, H. R. B. WALSHAW & A. W. LEE. *Iron & Steel Institute,* Advance Copy No. 7, Sept. 1936, 25 pages. Mixing breeze with slack increased shatter index of resulting coke. Coke made with breeze-blended slack increased coke consumption in the blast furnace. Breeze-blended coke had a lower abrasive index than coke formerly used. It was possible for shatter index to rise as abrasive index fell. Methods of sampling coke and their relation to shatter and abrasion test results are discussed. Properties of coke and swelling tests of different blends of slack from one plant are given. Fine grinding of slack improved coke for some blends but not for others. With fine grinding, ovens held a smaller weight of slack, but coking time was decreased so that actual production of coke was not altered. Data on operation of 1 blast furnace for 18 months and properties of coke charged during this period are given. Indications of effect of coke quality on operation are indefinite, but there is some indication that blast operation is improved by finer grinding of slack.
JLG (2b)

The Constitution of Blast-furnace Slags in Relation to the Manufacture of Pig Iron. T. P. COLCLOUGH. *Iron & Steel Institute,* Sept. 1936, Advance Copy No. 9, 27 pages. *Engineer,* Vol. 162, Nov. 6, 1936, page 487. *Iron & Coal Trades Review,* Vol. 133, Oct. 2, 1936, pages 563-565; Oct. 9, 1936, pages 608-611. Type and composition of blast-furnace slags in relation to the manufacture of pig iron are discussed. For optimum conditions of blast-furnace operation the burden should be arranged so that the slag formed has a melting point below 1400° C. (2250° F.) and preferably a practical maximum of 1375° C. (2500° F.). Difficulties experienced in the manufacture of basic Fe of low Si content from ores with high ratio of Al_2O_3 to SiO_2 are due to charging the furnace with a mixture of ore and limestone to form slags of higher melting point than 1375° C. To obtain slags of proper free-running properties and melting point the basicity factor or ratio of lime to silica must be decreased progressively from 1.15 for a slag of 18% Al_2O_3 to about 1.0 for slags of 5% or of 30% Al_2O_3 as the table shows.

Alumina content of slag	Ratio of lime to silica	
	Maximum	Minimum
%		
5	1.05	0.85
10	1.10	0.875
15	1.15	0.90
20	1.125	0.85
25	1.05	0.80
30	0.95	0.75

The application of these theoretical principles in a furnace and the good results obtained are described. Ha + JLG + LFM (2b)

3. MELTING, REFINING AND CASTING

Removal of Gases from Molten Metals. K. V. PEREDELSKI. *Liteinoe Delo,* Vol. 7, No. 8-9, 1936, page 13. Placing molten metal in a chamber connected with a source of vacuum degasifies it in 3-4 min. Slag and oxides are brought to the surface by gas bubbles. An Al alloy which before the degasification tested 28,200 lbs./in.^{2} tensile strength, 4.53% elongation and had a density of 2.89 showed after being degasified 31,300 lbs./in.^{2} tensile strength, 7.64% elongation and 2.98 density. (3)

Development of Casting in Permanent Molds (L'Evolution de la Coulée en Coquille) G. RIVOIRE. *La Fonderie Belge,* Vol. 4, Jan.-Feb. 1936, pages 377-379. Summarizes past development of the process, and shows the changes which have been applied to the casting of light alloy pistons. The possibilities of application of the process to the manufacture of castings made of various alloys are indicated. It is necessary to use alloy steels for the manufacture of casting dies (low C steels containing Ni-Cr-V). See *Metals and Alloys,* Vol. 7, Dec. 1936, page MA 574R/2. FR (3)

Selection of Hand-Molding Rammers (Considerations sur le Choix des Fouloirs) F. BOUSSARD. *La Fonderie Belge,* Vol. 4, Mar.-Apr. 1936, pages 404-408. Practical study of shape, size and weight of rammers. Best tool should have a rectangular shape instead of triangular one. Its bearing surface on sand should be as large as conditions permit. Weight varies from 1 to 5 kg. according to condition. FR (3)

Core Prints. V. M. ANDREEV. *Liteinoe Delo,* Vol. 7, No. 7, pages 15-18. In Russian. Suggested standardization of core points. (3)

Teach Students Patternmaking. FRED B. JACOBS. *Foundry,* Vol. 64, Oct. 1936, pages 66, 68. Outlines briefly methods and equipment used in the pattern shop of Case School of Applied Science, Cleveland. VSP (3)

Natural Bonded Moulding Sands of Canada. CORRELL H. FREEMAN. *Canada Department of Mines, Mines Branch Report* No. 767, 1936, 144 pages. Includes a discussion of synthetic or artificial moulding sands, reclaiming used sands, physical properties and methods of testing. AHE (3)

Use of Sulphite Extract as Core Binder. YU. YA. FINARTI. *Liteinoe Delo,* Vol. 7, No. 7, 1936, pages 31-39. In Russian. A comprehensive investigation to determine suitability of sulphite extract produced in paper manufacture for core binding purposes, both when used alone and in combination with other commonly known binders. With its use cores stick to core boxes and the quality of cores produced is low, though in emergency cases the substance can be used as a binder. (3)

What Does Practice Require of Molding Machines? (Was kann die Praxis von der Formmaschine verlangen?) U. LOHSE. *Giesserei,* Vol. 23, Sept. 11, 1936, pages 480-489. Types of molding machines, nature and effect of grain size of molding sand on the casting, tamping of the sand, and operation of molding machines are discussed. Ha (3)

Special Castings. I. H. LIST. *Mechanical World & Engineering Record,* Vol. 99, Apr. 10, 1936, pages 367-369. Describes work generally done by the jobbing shop, i.e. cases where a pattern for special or single pieces cannot be afforded in the marginal job. Typical examples are shown in 8 illustrations. WH (3)

Porosity of Die Castings. F. B. LORAND. *Liteinoe Delo,* Vol. 7, No. 8-9, 1936, pages 14-16. In Russian. Discussion of factors contributing to porosity of die castings. (3)

Solidification Time in the Casting of Ingots (Die Erstarrungsdauer beim Giessen von Blockformen) K. KNEHANS & N. BERNDT. *Technische Mitteilungen Krupp,* Vol. 4, Nov. 1936, pages 194-197. Cooling curves for ingots and molds of different dimensions were determined so that accidents due to too early stripping of the mold might be avoided. Ha (3)

Standardization of Dies for Die Casting. V. M. PLATSKI. *Liteinoe Delo,* Vol. 7, No. 8-9, 1936, pages 4-9. An attempt to standardize details common to most types of dies. (3)

3a. Non-Ferrous

G. L. CRAIG, SECTION EDITOR

Castings in Silumin Gamma. G. SACHS & E. SCHEUER. *Foundry Trade Journal,* Vol. 55, Sept. 17, 1936, pages 218-220. Abridged translation from Metallwirtschaft. The nominal analysis of the alloys of the Silumin-γ type is Si 12%, Mg 0.4%, Mn 0.5%, remainder Al, but the Si and Mg may both be varied within certain limits. Second only to the excellent casting properties of such alloys is the ease with which they can be heat treated. Heavy castings such as automobile Diesel engine housings weighing up to 900 lbs. can be quenched in cold water with perfect safety, in spite of the presence of sharp corners and large changes of section on the castings. Many other alloys with good intrinsic properties fail by intercrystalline cracking when subjected to rapid quenching and cannot be used for large castings that must afterwards be heat treated. The equipment necessary for the quenching of Silumin-γ is very simple. The casting is generally placed in an iron basket and held in position by loose clamps. The basket supports and the clamps must be kept as open as possible so as not to impede the free access of the quenching medium to all parts of the casting. Slight warping or distortion frequently occurs as a result of quenching, but straightening is easily carried out if done immediately after the treatment. In the aged condition the alloy is too hard to permit of any appreciable cold straightening being done. Age-hardened Silumin castings should be treated like cast Fe, that is, deformation should be avoided. The relations between casting, solution treatment, internal stress and mechanical properties are discussed. See *Metals and Alloys,* Vol. 7, Dec. 1936, page MA 603L/1. AIK (3a)

The Complex Interdependence of the Properties of Alloys and the Industrial Conditions of their Manufacture, Testing, and Use. R. DE FLEURY & H. PORTIER. *J. Inst. Metals,* Vol. 59, July 1936, pages 359-369 (Advance Copy No. 742); *Foundry Trade Journal,* Vol. 55, Sept. 17, 1936, pages 213-214, 224. Experience shows that in the best managed foundries the quality of the product is subject to inexplicable fluctuations which often disappear of their own accord. They are due to indirect factors, the influence of which is small but cumulative, such as the increase in the amount of impurities in the metal by repeated remelting. Method of classifying factors, influence on the properties of alloys of indirect factors during melting, interdependence of general external factors and the properties of alloys, foundry factors, thermodynamic factors, influence of modulus of elasticity, etc., are discussed. The strength and elastic limit of light alloys has been increased, while the modulus of elasticity has remained almost unchanged. The secondary factor of deformation consequently governs the factor of safety to an increasing extent. The importance of the modulus of elasticity was shown in the case of aero engines having their cylinders in line. These were subject to continual breaking of crank-shafts, due to deformation of the aluminum-alloy crank-cases. When the latter were made more rigid the trouble ceased, but it reappeared when they were cast in the same patterns from magnesium alloy of different modulus of elasticity. JLG + AIK (11a)

Metallic Sodium Production. I. J. MOLTKE-HANSEN. *Chemical Trade Journal & Chemical Engineer,* Vol. 99, Aug. 14, 1936, pages 126-127. Describes British patent 440,139 for electrolytic production of alkali and alkaline-earth metals, especially Na. They are produced by electrolysis of their fused salts in which electrodes of a metal other than that to be produced are used. Combination of 2 salts is used in the cell, one of which is electrolyzed, while the other reacts with the anodic products to form inert products and to reconstitute the substance decomposed. Diaphragms are provided for separation of anodic and cathodic products. MS (3a)

Eliminate Defects by Avoiding Common Pitfalls. N. K. B. PATCH. *Foundry,* Vol. 64, Sept. 1936, pages 25, 73. Discusses some of the faulty methods used and their elimination in nonferrous foundry. Some of them are the proper use of swab water, careful measurement of core prints in core box, method of pouring the metal, etc. VSP (3a)

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3b. Ferrous

C. H. HERTY, SECTION EDITOR

The Metallurgy of Pig Iron Production by a New Process, with Particular Attention to Desulphurization Phenomena (Ueber die metallurgischen Grundlagen der Herstellung von Giessereiroheisen im Rahmen eines neuer Verhüttungsverfahrens unter besonderer Berücksichtigung der Entschwefelungsvorgänge) M. PASCHKE & E. PEETZ. *Giesserei,* Vol. 23, Sept. 11, 1936, pages 454-460. A new method of producing pig Fe, based on suitable desulphurization after tapping rather than in the blast furnace, is described. Molten pig Fe and slag from an acid S-rich charge are produced in the blast furnace using high S coke. Flux (limestone) is added in such amount that a low melting acid slag, and an Fe high in S is produced. The latter is desulphurized, after tapping, with a basic slag or otherwise. Amount of slag and limestone, and coke consumption are reduced. The use of subsequent soda treatments and the practical application of the method are illustrated. Ha (3b)

Foundry Practice and Methods of Control of Cast Iron for Porcelain Enameling. R. B. SCHAAL, *The Enamelist,* Vol. 14, Oct. 1936, pages 18-26, 54-58. In the selection of raw materials, pig Fe of high C and low S content should be chosen from brands known to give good results. Pb-bearing enameled foundry returns should be avoided. Scrap should be the best No. 1 cast Fe machinery scrap, avoiding any which contains Cr, Mo or V. The coke selection is influenced by its density and ash and S content. Good cupola operation demands the control of air volume and pressure, a rapid and hot melting, a heavy, fluid slag and proper charging. The cast iron product should be mainly pearlitic with some ferrite and should analyze: Si 2.65-2.70%, Mn 0.70%, P 0.70-0.75%, S 0.75%, T.C. 3.55%, C.C. 0.45%, F.C 3.10% and no alloys. Facings, especially of graphite or C, should be used sparingly. Castings should cool in the molds but must be removed before they absorb moisture. Storage and cleaning also require careful control. PCR (3b)

Grain-Size and McQuaid-Ehn Test. ALBERT PORTEVIN. *Metal Progress,* Vol. 30, Nov. 1936, pages 55, 92, 94. Relation of Al and V additions to grain size control is discussed. WLC (3b)

Pearlitic Malleable Cast Iron. *Foundry Trade Journal,* Vol. 55, Aug. 20, 1936, pages 135-138. An American symposium organized by the American Society for Testing Materials. AIK (3b)

The Reaction Processes in the Basic Open-Hearth Furnace (Das Reaktionsgeschehen im basischen Siemens-Martin-Oefen) G. LIEBER. *Mitteilungen aus dem Kaiser-Wilhelm-Institut für Eisenforschung, Düsseldorf,* Vol. 18, No. 10, 1936, pages 135-147. The investigation was made to determine the O content in liquid basic open-hearth steel. Two actions are distinguished: (1) the reducing action of the C in the bath and (2) the oxidizing action of the gas phase. The decarburization process consists of 3 stages: (a) The reaction of the FeO dissolved in the melt with C, and the formation of a small amount of CO which at first dissolves in the steel melt, (b) the dissolved CO is evolved from the steel melt as a gas and (c) the FeO consumed by (a) and (b) is steadily replaced from the slag. The theoretical basis for these conditions is derived. The upper limit of O is given by that O content which corresponds to equilibrium in the distribution of oxide between bath and slag, while the lower limit is given by the equilibrium of the reaction between C and the dissolved oxides in the liquid steel. As long as the melt is boiling, its O content lies close to the lower limit. The effect of Mn on the reactions is discussed; the O content must be lower in the bath for Mn reactions than the slag equilibrium value if the O supply of the slag is to be utilized. The necessary conclusions are that equilibrium between bath and slag cannot exist in the usual physico-chemical sense as long as there remains an excess of active C. 16 references. Ha (3b)

Problem of Casting Quality (Le Problème de la Qualité des Moulages) S. S. NEKRYTY. *La Fonderie Belge,* Vol. 4, Jan.-Feb. 1936, pages 373-377. Paper read at the International Foundry Congress of Brussels, Sept., 1935. For Fe castings it is advocated to control the composition in order to give the value 3-3.5 for the "graphitization number" K, given by the following formulas.

For thin castings: $K = \frac{2\,(\%\text{Si}) + (\%\text{Ni})}{1.5\,(\%\text{Cr}) + (\text{Mn} - 1.7\%\,\text{S})}$; For medium castings: $K = \frac{2\,(\%\,\text{Si}) + (\%\,\text{Ni})}{(\%\,\text{Cr}) + (\%\,\text{Mn} - 1.70\%\,\text{S})}$; For thick castings: $K = \frac{1.5\,(\%\,\text{Si}) + (\%\,\text{Ni})}{(\%\,\text{Cr}) + (\%\,\text{Mn} - 1.7\%\,\text{S})}$. Author deals with natural alloy cast iron pigs produced from Russian ore containing Ni-Cr-Ti, discusses the use of this special cast Fe in the production of heat and corrosion resisting castings and explains how heat treatment can improve castings obtained. He concludes by a study of the possibility of using this special cast Fe in steel manufacture. FR (3b)

Iron Oxide Should be held at a Minimum in Carbon Steel. FRANK M. MEYERS. *Foundry,* Vol. 64, Sept. 1936, page 61. A simple and efficient method for determining properly finished C steel before tapping metal from furnace into ladle is as follows: Cast a bar $\frac{5}{8}$" x $\frac{5}{8}$" x 12" in vertical dry sand core, taking metal out of furnace with test spoon. After casting let it cool in core until dark, then cool in H_2O. Bend bar into U-shape. If this is accomplished metal is finished and heat is ready to be tapped. If bar fractures before U is completed there is too much oxide in metal and further refining is needed. Test is only good for steels with C 0.30% and under. Deoxidizers should be used only as a secondary precaution in minimum quantities. VSP (3b)

Melting High Test Cast Iron in Small Cupola (La Fusion des Fontes de Qualité au Petit Cubilot. Avantages Techniques et Économiques) G. HÉNON. *Bulletin de l'Association Technique de Fonderie,* Vol. 10, May 1936, pages 177-183. Paper presented at Foundry Congress, Lille, 1936. Cupolas of 14 to 24 in. in diameter are economical units for melting small heats of special cast iron. During melting it was found that the C pick-up and the Si and Mn losses were all lower in the small cupola than in the regular large cupola. The principal disadvantages of the small cupola are variation in composition of metal from ladle to ladle and the operation difficulties of this small unit. Details of construction, operation and uses of small cupolas are given. 11 references. WHS (3b)

Thermo-Chemistry of Cupolas. Its Application to the Study of Melting and Superheating of Cast Iron (La Thermo-Chimie des Cubilots: Son Application à l'Etude de la Fusion et de la Surchauffe de la Fonte) A. POUMAY, JR. *La Fonderie Belge.* Vol. 3, Jul.-Aug. 1934, pages 102-109. Examples of computation of efficiency are given for 5 different cases of melting (conditions are different in each case). See *Metals and Alloys,* Vol. 6, Feb. 1935, page MA50R/1. FR (3b)

Effect of Mold Coating. J. H. HRUSKA. *Blast Furnace & Steel Plant,* Vol. 24, Sept. 1936, page 807. Tests were made to determine effect of mold coating, and were conducted under strictly comparable conditions. Coating consisted of a mixture of tar, kerosene, and Al. Care was taken to avoid any accumulation of mixture on mold wall or on stool. Rejected ingots showing surface imperfections averaged 4.11% for ingots teemed into uncoated molds. With coated molds, average dropped to 1.46% and upon application of a new spraying device, to 0.84%. Chemical analysis of drillings taken at identical locations in ingots of the same heat teemed into coated and uncoated molds showed that surface segregation was caused directly by migration of part of the C of coating into solidifying steel. Variations of 0.01 to 0.13% C. were found in ingots of different chemical compositions. MS (3b) 1 2

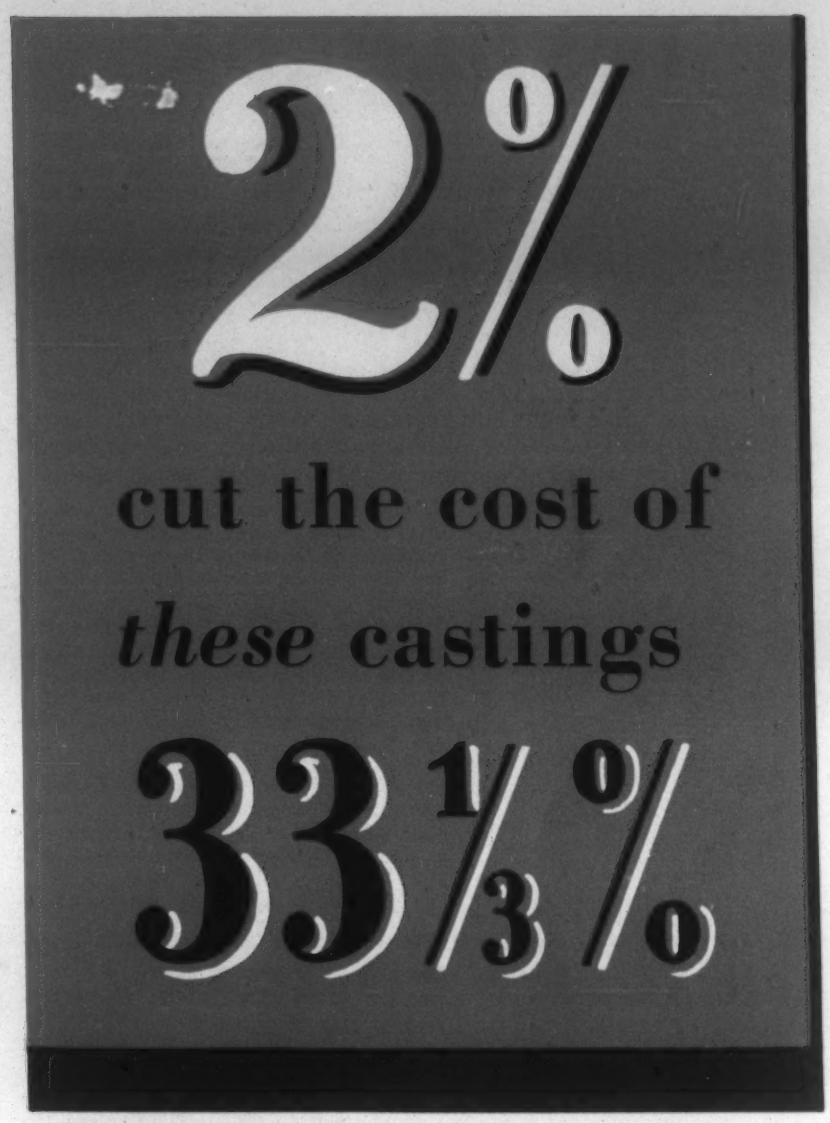
Open Hearth Melting Practice. THOMAS G. FOULKES. *Metal Progress,* Vol. 30, Nov. 1936, pages 61-66. Duplexing and triplexing, the differences between acid and basic practices and their reactions, raw materials for several practices, pit practices and grain size control of open-hearth steel are discussed. WLC (3b)

Large Pot Casting is Made in Mold Swept Up in Loam. PAT DWYER. *Foundry,* Vol. 64, Aug. 1936, pages 22-24, 66. For certain classes of castings, particularly circular castings, loam molds guarantee a perfect casting, clean solid and true to size, and in addition, pattern making costs are reduced. Describes mold made at the plant of Kilby Mfg. Co., Cleveland. The castings formed part of a plant for processing tar and known as saturator bottoms. The complete casting was 13 ft. diam., 5 ft. 2 in. high, 1¼ in. thick and weighed 14,650 lbs. Gives details of procedure. VSP (3b) 3 4

Operate Shop on Pacific Coast. PAT DWYER. *Foundry,* Vol. 64, Sept. 1936, pages 22-24, 70, 73; **Anneals Malleable In 28 Hours.** Oct. 1936, pages 30-32, 80. Describes the plant of the Olympic Foundry Co., Seattle, Wash., specializing in marine castings. Other type castings also made. Gray Fe melted in 3 cupolas, while malleable Fe is melted and annealed in electric furnaces. Second instalment gives details of melting and annealing malleable Fe in electric furnaces. VSP (3b) 5

Use of Soda Ash as Desulphurizing and Physical Purifying Medium of Cast Irons and Steels (L'Emploi du Carbonate de Soude comme Agent de Desulfuration et d'Epuration Physique des Fontes et des Aciers) ACHILLE G. LEFEBVRE. *La Fonderie Belge,* Vol. 4, Jan.-Feb. 1935, pages 184-192; Mar.-Apr. 1935, pages 199-219; May-June, 1935, pages 241-252; July-Aug., 1935, pages 307-322. According to the theory of this action, Na is liberated as a vapor during the treatment and reacts with the S in the metal to form a sulfide; the CO and CO_2 also liberated provide efficient stirring action. Desulphurization by Na_2CO_3 is compared with other desulphurizing processes and the beneficial effect of Na_2CO_3 treatment is illustrated by several micrographs of treated and untreated metal. The types of available soda ash that may successfully be applied, and the correct methods of application are given: For ladle treatment the metal surface should not be sprayed with sand and the metal must be kept free from slag coming from the cupola; ladle treatment is satisfactory for metal running from a blast furnace, cupola or mixer and is useful in the production of malleable cast Fe. Direct treatment of steel with soda ash has not been successful, but ladle treatment before transfer to the open-hearth furnace is satisfactory. Best results in cast iron production are obtained when the forehearth is of the gyratory type. The final section discusses addition of Na_2CO_3 in the burden, and describes and illustrates apparatus and equipment required for the soda ash treatment. Bibliography is appended. See *Metals and Alloys,* Vol. 7, Mar. 1936, page MA 115 L/5. FR (3b) 6 7 8

The Determination of Non-Metallic Inclusions in Steel and Iron. E. W. COLBECK, S. W. CRAVEN & W. MURRAY. *Iron & Steel Institute,* Sept. 1936, Advance Copy No. 8, 22 pages. Various methods for isolation and analysis of non-metallic inclusions are reviewed. A detailed description of the use of Cl for this purpose is given, and its effects at different temperatures on SiO_2, Al_2O_3, Fe_2O_3, and Mn_3O_4 outlined. These oxides were tested both singly and as mixtures in the presence of C. Comparative results obtained on a number of C steels by several solution methods are given, particular attention being directed to use of Cl and I. Tests were made with both drillings and solid sections. Typical residues from Cl and I were examined by X-ray diffraction, and it was found that MnS is not completely soluble in I. Alloy steels were studied with the Cl method, and Cr steels yielded residues containing Cr. X-ray studies of residues from cast Fe showed that Fe_3P is quantitatively retained in residues from I extraction. The effect of sulfides and Fe_3P with the Cl method is uncertain. 21 references. JLG (3b) 9 10



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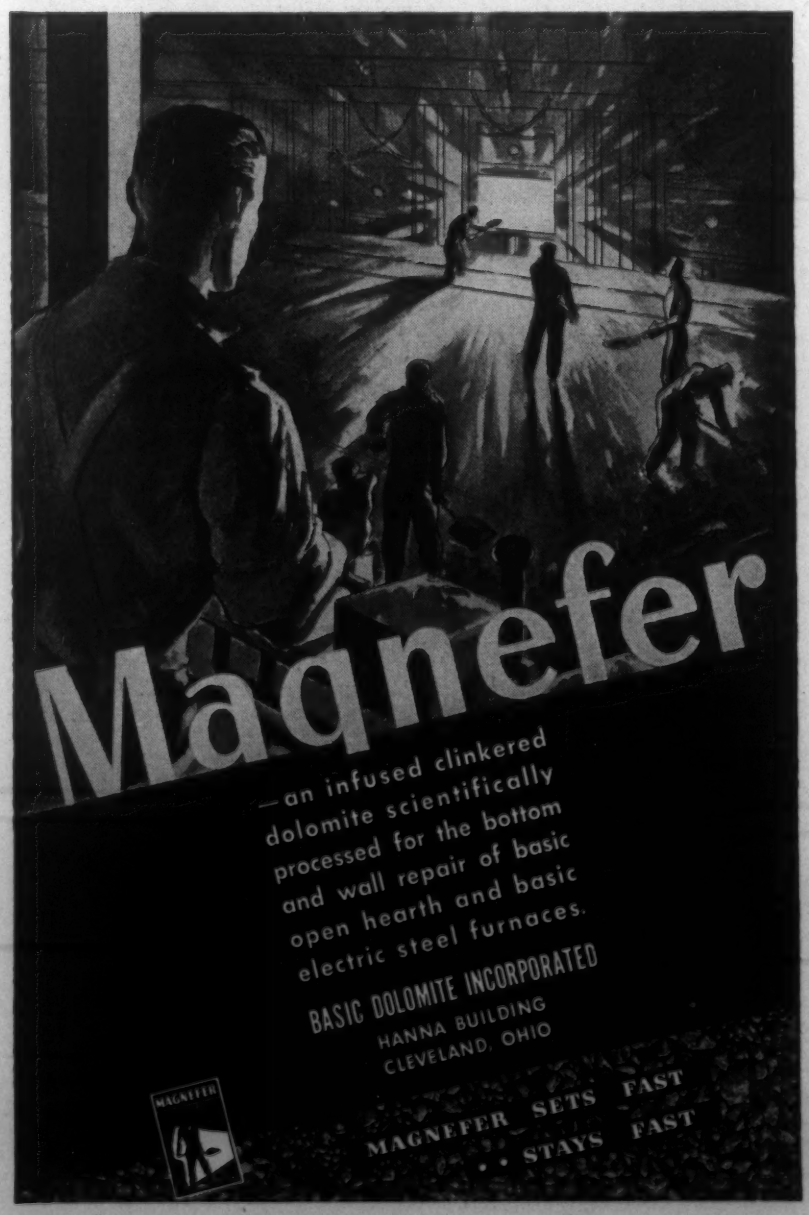
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1 **Production of Steels with a Given Size of Austenitic Grain.** K. I. ANTIPOV & V. A. IVANCHENKO. *Kachestvennaia Stal,* Vol. 4, No. 5, 1936, pages 47-48. In Russian. Sketchy description of 22 heats of Cr-Ni steels made under production conditions. (3b)

— **The Free and Hindered Contraction of Alloy Cast Steels.** C. W. BRIGGS & R. A. GEZELIUS. *Foundry Trade Journal,* Vol. 54, June 11, 1936, pages 461-464. See "Studies on Solidification and Contraction in Steel Castings, II," *Metals & Alloys,* Vol. 6, Oct. 1935, page MA 392L/7. AIK (3b)

2 **Influence of Atmospheric Humidity on Dry Sand Molds (L'Influence de l'Humidité Atmosphérique sur les Moules Séchés et sur les Noyaux sans Agglomérants Artificiels).** BOHUSLAV HOLMAN. *Bulletin de l'Association Technique de Fonderie,* Vol. 10, June 1936, pages 213-221. Czechoslovakian exchange paper presented at the 15th Annual Congress of the A. T. F. At 50% humidity, dried natural molding sands will absorb from 0.1% to 2.1% of water, depending on the clay content and bond strength of the sand. As moisture is absorbed
3 the strength of the dry sand mold or core decreases. 10 sands were studied. WHS (3b)

— **Dirt causes Cylinder Trouble.** *Foundry,* Vol. 64, Oct. 1936, page 62. Hard core or sand washing from the gate may result in defects in bottom of bore. Considers a gas engine cylinder casting which develops porous areas on drag side of bore during machining. Usually jacket core is responsible for the trouble.
4 Core must be made entirely of sharp sand bonded with minimum amount of oil and heated almost to burning point in order to produce a permeable core containing minimum amount of gas producing material. Sometimes bubbles are caused by poorly vented bottom surface on main core. Cause of dirty area in
— bottom of bore is foreign material floating on Fe. This material may be sand washed in from runners. VSP (3b)

5 **Chill is Released to Permit Contraction.** *Foundry,* Vol. 64, Aug. 1936, page 57. Describes the chilling of a pulverizer casting on the inner face. Casting is 50" outside diam., 40" inside diam., with fairly uniform metal thickness bottom and sides of 5". Chill is formed in several sections, in this instance 12 sections 10" long on face. 10 are cut on radial lines while 2 are
— cut with taper in opposite direction, forming the keys. Gives details of procedure. VSP (3b)

6 **Producing Auto Brake Drum Castings.** R. CAMPBELL WELLMAN. *Foundry,* Vol. 64, Oct. 1936, pages 22-23, 72. Describes present day methods and equipment adopted for producing automobile brake drums by the Ferro Machine & Foundry Co., Cleve-
— land. The company maintains production of about 4000 brake drums, of steel plate and cast Fe rim in 8 hrs. Molds for single castings are made in steel flasks. Hot metal is introduced through a single sprue and numerous gates in drag. Pouring temperature
7 of metal is about 2750°F. Casting weighs 14 lb. with steel plate, 11½ lb. finished and requires machining with an accuracy to within fraction of an oz. Sand used in production of molds has a permeability ranging from 35 to 45, moisture content from 6
— to 6½%, compression strength of about 6 lb. and artificial bond of about 2½ to 3%. VSP (3b)

8 **Determination of the Gases in Steel by the Hot Extraction Method.** G. THANHEISER. *Iron & Steel Institute,* Sept. 1936, Advance Copy No. 4, 23 pages. Describes investigation carried out at Kaiser-Wilhelm-Institut für Eisenforschung. A new type
— of C-resistor furnace designed at the Institute is described. Results obtained with this furnace are as good as those obtained with high-frequency furnace. Data were obtained that indicated that CO reacted with sublimed Mn, and a design of furnace was
— developed to reduce the error introduced by this reaction. The determination of N and H by vacuum fusion was studied. Errors in analyzing the gases evolved may give incorrect values for N.
9 Examples of O and H determinations for metallurgical investigations are given. 17 references. See *Metals and Alloys,* Vol. 7, July, 1936, page MA 344 L/8. JLG (3b)

— **Green Sand Used for Steel Castings.** WILLIAM F. ROSE. *Foundry,* Vol. 64, Aug. 1936, page 44. Green sand molds are particularly well adapted to production of steel castings subjected to high pressure and where extensive machining, assembling and other operations amount to considerable of total cost. Describes
10 the production of a steel ring casting which is to be subjected to a pressure of 4000 lb./in.^{2} See *Metals and Alloys,* Vol. 6, Sept. 1935, page MA 353 L/6. VSP (3b)

Carbon of Cast Iron (Le Carbone des Fontes). E. VROONEN. *La Fonderie Belge,* Vol. 3, Sept.-Oct. 1934, pages 125-141. See *Metals and Alloys,* Vol. 5, Feb. 1934, page MA 42. FR (3b)

4. WORKING

Hot Milling—A Review of Practice at the Mines of the Vinegar Hill Zinc Co., Platteville, Wis. WING G. AGNEW. *Canadian Mining Journal,* Vol. 58, Jan. 1937, pages 11-12. Illustrated description of a hot miller used on rock-drill bits at this plant. WHB (4)

4a. Rolling

S. EPSTEIN, SECTION EDITOR

The Cold Rolling of Strip Steel. L. DWIGHT GRANGER. *Modern Machine Shop,* Vol. 9, Dec. 1936, pages 68-80. The evolution of cold-rolling practice, advantages of more than 2-high stands, and properties of cold-rolled steel are discussed. Ha (4a)

Direct Rolling of Aluminium. An American Installation. *Sheet Metal Industries,* Vol. 10, Dec. 1936, pages 925-926, 938. A discussion of a direct rolling installation as described by T. W. Lippert in a recent issue of *Iron Age.* AWM (4a)

Motors for Steel Works. *Electrical Review,* Vol. 119, Aug. 28, 1936, page 275. Brief article, signed "Engineer," dealing with design and ratings. MS (4a)

Rolls for Sheets or Straps (Cylindres à Tôles ou Feuillards) *La Fonderie Belge,* Vol. 3, May-June 1936, page 89. Short abstract from the *Revue du Nickel,* No. 2, Apr. 1934. FR (4a)

On Spreading in Rolling. W. TRINKS. *Blast Furnace & Steel Plant,* Vol. 24, Sept. 1936, pages 785-788. Discusses unobstructed spreading of hot steel between cylindrical rolls on basis of tests made by A. SPENLE, *Stahl und Eisen,* Vol. 56, May 7, 1936, pages 544-549, see *Metals and Alloys,* Vol. 7, Aug. 1936, page MA 401L/2 and by O. EMICKE & E. PACHALY, *Stahl und Eisen,* Vol. 56, May 21, 1936, pages 589-599. As the Sedlaczek formula *(Stahl und Eisen,* Vol. 45, pages 190-193) was found to be accurate only for average rolling speeds, tabulates approximate multipliers to correct for influence of rolling speeds from 0 to 3000 ft./min. Derives from Spenle's data approximate factors to correct for kinds of steel used. Numerical value of spreading is affected by other variables, but not enough is known about them to permit their being taken into account. Simplifies Sedlaczek formula to

$$\frac{\text{Spreading}}{\text{Draft}} = \frac{\sqrt{\text{roll diam./original width}}}{3.25\left(1+\left(\frac{\text{average thickness}}{\text{original width}}\right)^2\right)}$$

and plots curves from this equation. They show that spreading increases with roll diam. and that it decreases if width of a bar of given thickness is increased. MS (4a)

The Roll Problem in Backed-up Mills for Cold Reduction. GEO. A. V. RUSSELL & S. S. SMITH. *Sheet Metal Industries,* Vol. 10, Oct. 1936, pages 759-761; Nov. 1936, pages 845-848; Dec. 1936, pages 930-932. Extracts from a paper presented at the Autumn Meeting of the Iron and Steel Institute in Düsseldorf. General characteristics of working and backing rolls are given. C-Cr steel rolls (C .85 to 1.0% and Cr 1.0 to 2.0%) are preferred for working rolls, while composite rolls having a forged steel shaft with a shrunk-on steel shell are most satisfactory as backing rolls. Failures are classified as (a) manufacturing defects, (b) surface defects, and (c) fractures. The authors recommend a standardization of manufacturing and inspection methods—beginning with an all-Swedish iron base or high-grade clean scrap charge and ending with oil-bath tempering. See *Metals and Alloys,* Vol. 8, Mar. 1937, page MA 140R/6. AWM (4a)

4b. Forging & Extruding

A. W. DEMMLER, SECTION EDITOR

Methods of Forging Crankshafts. S. F. DOREY. *Mechanical World & Engineering Record,* Vol. 99, Jan. 3, 1936, pages 7-9, 24. Aided by over 50 illustrations, the production of solid-forged and semi-built crankshafts is discussed stressing the changes of physical properties due to different methods of forging. WH (4b)

Atlas Drop Forge Company. W. C. KERNAHAN. *Heat Treating & Forging,* Vol. 22, July 1936, pages 325-326. Describes buildings and forging, heat treating, machine-shop, and miscellaneous equipment in plant at Lansing, Mich. MS (4b)

How Chevrolet Motor Valves are Extruded. J. B. NEALEY. *Iron Age,* Vol. 138, Sept. 24, 1936, pages 28-29. Describes methods employed at the Flint, Mich., plant in extruding motor valves from bar slugs. Composition of steel is: C 0.40-0.50; Mn 0.30-0.50; Si 3.00-3.50; Cr 8.00-10.00, and P and S 0.025%. Heating is done in battery of slot type gas-fired furnaces. Stock is heated to 1500° F. and 15/16" slugs cut off and smoothed up in tumbling barrels. They are reheated to 2000° F., extruded, and restruck in a 300-ton punch press. VSP (4b)

4c. Cold Working — Shearing, Punching, Drawing & Stamping

High-Speed Wire Production by the Wet Process. RICHARD SAXTON. *Mechanical World & Engineering Record,* Vol. 100, Oct. 16, 1936, pages 368-371. Illustrates and discusses the latest type of machine employed in the wet process for continuous Cu and brass wire production. W-carbide dies curtailed die wear fully 75% in several branches of wet process work but the carbide unit has not yet proved a commercial success in sizes smaller than 0.004 in. Pt coated with Ag can be easily drawn to fine sizes. Cu coating is applied to mild steel wire drawn by the wet process. WH (4c)

Fabrication of Cold-Drawn Welding Rods. RICHARD SAXTON. *Sheet Metal Industries,* Vol. 10, Sept. 1936, page 713. General discussion. Points out the need for elimination of H absorbed in pickling hot-rolled stock. AWM (4c)

Tools for Cold Heading. *Mechanical World & Engineering Record,* Vol. 99, May 8, 1936, pages 467-469. Cold upsetting of metal is an old process, and making tools for this work is something of an art. Detailed instructions aided by many illustrations are given. WH (4c)

Modern Presses and Stamps (Neuzeitliche Pressen und Stanzen) *Emailwaren-Industrie,* Vol 13, Oct. 29, 1936, pages 357-359. A discussion of the operation of new presses and stamps. RAW (4c)

4d. Machining

H. W. GRAHAM, SECTION EDITOR

A Study of Cutting Fluids Applied to the Turning of Monel Metal. O. W. BOSTON & W. W. GILBERT. *Transactions of the American Society of Mechanical Engineers,* Vol. 58, Nov. 1936, pages 685-689. The behavior of high-speed tools for turning forged Monel metal with various cutting fluids was investigated. Emulsions seem to be satisfactory, especially sulphurized emulsions of mineral oils but the latter stained the metal and are unpleasant to work with. Practical hints for most suitable tool shape given. Ha (4d)

Metal Cutting and the Selection of Cutting Fluids. *Lubrication,* Vol. 22, Nov. 1936, pages 121-132. The function of cutting fluids as coolants and lubricants in machining operations is discussed. Types of cutting fluids most extensively used today are straight mineral oil, mineral lard oil, sulphurized mineral lard and mineral oil, and soluble oil. The fields of application of these groups and the preparation of suitable solutions and emulsions are described. Ha (4d)

Production of Staybolts for Locomotive Boilers. *Railway Gazette,* Vol. 66, Jan. 1, 1937, pages 24-25. Describes and illustrates lathe permitting rapid production of Cu staybolts for fireboxes, with great accuracy and without strain on the operator. Size range handled is from 7/8 to 1 3/8" in diameter and from 4 to 8 3/4" in length. FPP (4d)

5. HEAT TREATMENT

O. E. HARDER, SECTION EDITOR

Cooling of Rails on Cooling Beds. M. I. BOYARSHINOV. *Metallurg,* Vol. 11, July 1936, pages 72-84. In Russian. A comprehensive study of two types of rails. Cooling time under the most unfavorable conditions (air temperature of 35° C. and complete filling of beds) was 4 and 3.5 hrs. respectively, average cooling speed being 4-5° C. per min. On this basis, 18 m.² of cooling bed area are required for each ton of hourly capacity. Cooling is not uniform either along the periphery or cross section, temperature spread between different portions of rails might be as high as 100° C. Difference between inside and outside temperature reaches 90° C. in the foot and 130° in the head, being greatly affected by the drafts. Rails cooled at different rates have different physical properties, non-uniformity in cooling affecting particularly plastic characteristics of the metal, slower and more uniform cooling resulting in higher plastic properties. Non-uniform cooling creates internal strains in rails, as demonstrated by changes in physical properties with time, dilatometric determinations during annealing, changes in the length of rails during straightening and the character of fracture during tup testing. (5)

Special Atmospheres for Industrial Furnaces. W. A. DARRAH. *Industrial Heating,* Vol. 4, Jan. 1937, pages 26-30, 38. Gases used for heat-treatment of steel (CO, CO_2, NH_3, H_2 and mixtures), their production from city gas, natural gas, oil, coke, etc., and the effect on the material are discussed at length. Ha (5)

Normalizing Tubes in Controlled Atmosphere Furnaces. FRED L. PRENTISS. *Iron Age,* Vol. 138, July 30, 1936, pages 18-22, 80. Steel tubing for boilers and other pressure purposes manufactured by electric resistance welding process is normalized in controlled atmosphere continuous electric furnace by Steel & Tubes, Inc. The furnace is the largest and the first to be used for steel tubing. Describes the method of procedure in producing tubing free from scale without pickling. VSP (5)

Heat-treating Gear Stock. W. O. OWEN. *Industrial Gas,* Vol. 15, Jan. 1937, page 20. Special furnaces with a temperature range from 850°-1800° F. are briefly described. Ha (5)

5a. Annealing

Gas Evolution during Annealing of Sheet (Gasentwicklung beim Glühen von Blechen) H. MONDEN & K. SKROCH. *Stahl und Eisen,* Vol. 56, Dec. 17, 1936, pages 1532-1535. The gases evolved during box annealing of sheet are mainly CO_2, CO, and H_2. At 700-800° C. a lowering of gas pressure occurs which apparently is to be attributed to H_2 absorption by the steel. SE (5a)

Annealing in Controlled Atmospheres. W. A. DARRAH. *Industrial Heating,* Vol. 3, Oct. 1936, pages 671-678, 701-702. Economic advantages of using controlled atmospheres in heat treating process, especially in bright annealing, discussed at length and furnace details described. Ha (5a)

Composition and Amount of Gases Produced in Annealing Dynamo Sheets. G. M. KOROVIN. *Kachestvennaia Stal,* Vol. 4, No. 8-9, 1936, pages 36-38. In Russian. Strips of 1% Si dynamo sheets were placed in a tube furnace closed with rubber stoppers and connected with an aspirator. Both pickled and unpickled inside and outside sheets of a pack were used. Furnace was heated to 610-870° C. and kept at temperature for several hours. Annealing of pickled sheets resulted in a small gas evolution even at 870° C. and comparatively small drop in C content. In raw sheets C elimination proceeds rapidly starting at 670-780° C. and is not finished in 5 hours even at 870° C. Inside and outside sheets behave similarly. (5a)

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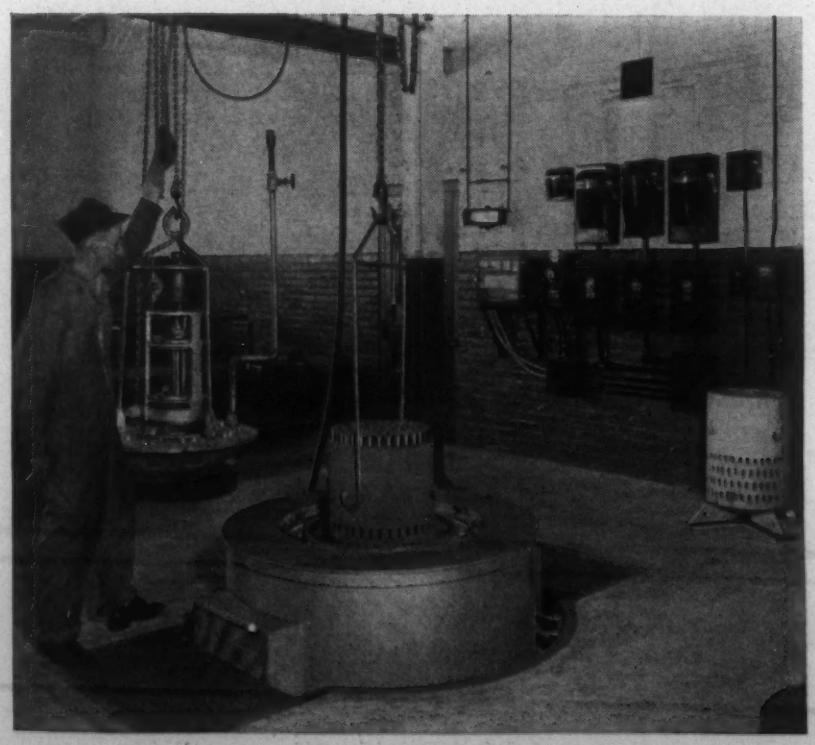

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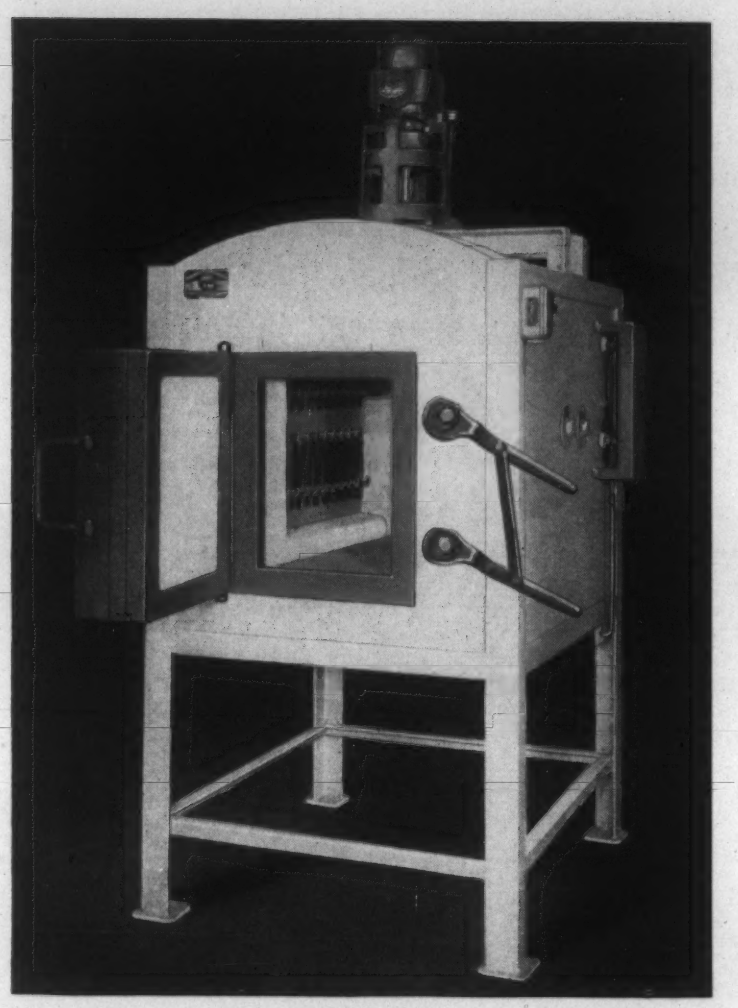

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5b. Hardening, Quenching & Drawing

Flame Hardening Presents Economical Heat Treating Method. G. V. SLOTTMAN. *Steel,* Vol. 99, Nov. 9, 1936, pages 42-44. Simple welding or heating torch can be used for oxy-acetylene flame hardening. Supplementary equipment is described. To expedite handling of flame-hardening problems it is necessary to indicate depth and degree of hardness desired and composition of steel, and to have dimensional drawings showing area to be hardened and, if practicable, suitably sized specimens for hardening trials. MS (5b)

Patenting and Heat Treatment of Steel Wire (Patentieren und Vergüten von Stahldraht) R. WALZEL & R. MITSCHE. *Stahl und Eisen,* Vol. 56, Dec. 3, 1936, pages 1480-1484. The study was made to determine whether the properties of oil quenched and tempered wire could be made to equal those of patented wire, i.e., wire quenched in a molten lead bath. Even when the structures at X250 appeared similar after both types of treatment, the patented wire had superior properties to the quenched and tempered wire. As a matter of fact micrographs at higher magnification (X 2000) indicated the structures were really not similar, the quenched and tempered structures being somewhat more angular showing vestiges of the martensitic needles obtained in quenching. SE (5b)

Cementation of Cast Iron by Beryllium (La Cémentation de la Fonte par le Glucinium) G. DUBERCET. *Revue de Fonderie Moderne,* Vol. 30, Dec. 25, 1936, pages 360-361. A cast Fe of 3.53% total C, 3.08% graphite, 2.47% Si, 0.66% Mn, 0.033% S and 0.354% P was cemented by metallic Be of 98% purity and by ferroberyllium with 80% Be, both finely powdered. Although the Vickers hardness of the material before treatment was 194, the hardness (after 10 hrs. at each temperature) was at 800° C. 187, at 900° 960, at 1000° 1561, at 1100° 1312, at 1150° 421. These figures apply for treatment with ferroberyllium; the results with metallic Be were similar but the penetration is slower, about 0.4-0.5 mm. after 2½ hrs., while with ferroberyllium it is 0.9-1.25 mm. The treatment considerably improves the resistance to weathering and water, but not to corrosion by acids or bases. Ha (5b)

Localized Surface Hardening. R. L. ROLF. *Steel,* Vol. 99, Nov. 30, 1936, pages 32-36. Composition of steel is an important factor in hardening by oxyacetylene flame; steels only slightly abnormal and having a McQuaid-Ehn rating of 6-8 are preferable. A hard wearing surface is produced without affecting original core properties; machine hardening is done by either the progressive or spinning methods. Outlines equipment used and describes some applications. MS (5b)

Electric Heat Treating of Wire. O. C. TRAUTMAN. *Iron Age,* Vol. 138, Oct. 15, 1936, pages 34-39. Describes a new process for heat treatment of spring wire by electric resistance method at the plant of Cleveland Wire Spring Co. Cites various advantages of process and includes a table giving comparative physical properties for "alloy" and oil quenched wires and a number of graphs. VSP (5b)

Autogenous Hardening of Thin Sheets, particularly Brake Drums (Autogenhärtung dünner Bleche unter besonderer Berücksichtigung der Bremstrommelhärtung) H. KLEINER. *Autogene Metallbearbeitung,* Vol. 29, Dec. 1, 1936, pages 353-360; Dec. 15, 1936, pages 369-377. The oxy-acetylene flame was found suitable for developing a hardness in thin plain-C steels equivalent to that of alloy steels, or to harden small areas locally. Theoretical principles are explained and method of hardening automobile brake drums described. Structure, internal stresses, and process economy were investigated. Ha (5b)

5c. Aging

Physico-Chemical Nature and Properties of Alloys of the Lautal-Type. G. G. URASOW & G. M. ZAMARUEV. *Izvestia Sektora-Fiziko-Khimicheskogo Analiza,* Vol. 8, 1936, pages 255-267. In Russian. The change of the hardness of aluminum alloys with 4.0-4.54% Cu and 1.4-2.0% Si was investigated by aging at 100, 125, 145, 165, 175, and 195° C. for 90 hrs. The hardness maximum is reached at 145° C. NA (5c)

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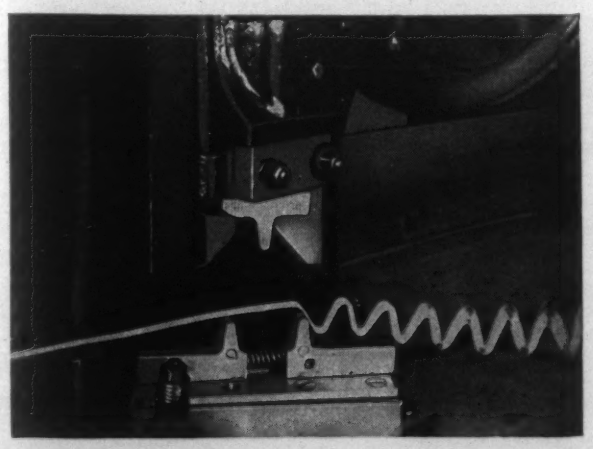

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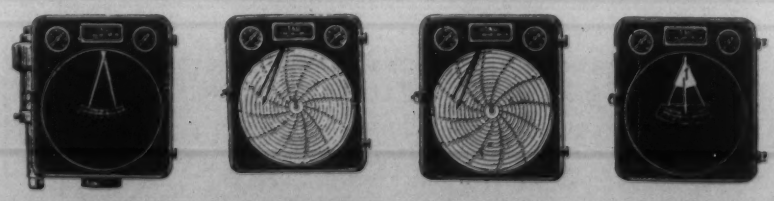

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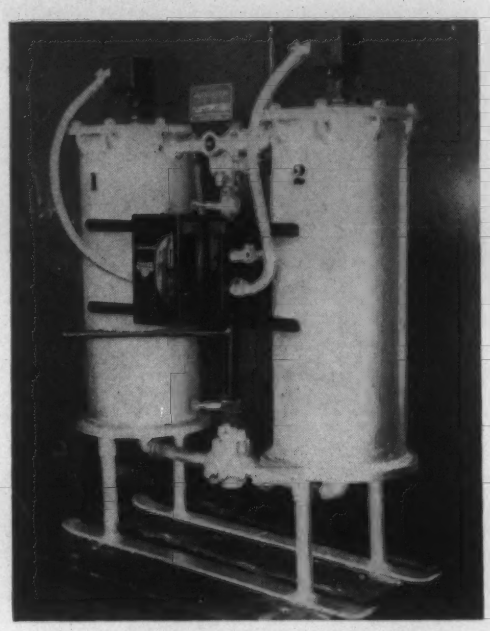

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Influence of Temperature Cycle in Quenching Duralumin. A. I. GORNOSTAEV. *Metallurg*, Vol. 11, May 1936, pages 95-97. In Russian. Experiments conducted with alloys containing 4.4-4.8% Cu, 0.81-0.98% Mg, 0.72-0.90% Mn, remainder Al, showed that the quenching range 500-506° C. gave the best results Slight deviations from it caused losses in physical properties. (5c)

5e. Carburizing

Types of Carbon Diffusion in Steel. S. S. KANFOR. *Metallurg*, Vol. 11, Sept. 1936, pages 43-50. In Russian. All diffusion processes of C into steel can be subdivided into 8 groups, 4 in stable and 4 in unstable space lattice of Fe. They are: normal pure diffusion, normal reaction diffusion, forced pure diffusion and forced reaction diffusion. An example of each are (1) equalization of C content during annealing; (2) coagulation of cementite; (3) precipitation of ferrite on cooling or in ordinary carburization; (4) cementite precipitation on cooling hypereutectoid steels; (5) solution of ferrite on heating; (6) transformations occurring at A_{e1}; (7) carburizing reactions during which specimens are alternately and cooled; (8) carbon diffusion during austenite decomposition. Experiments have shown that the speed of diffusion of C in Fe lattices during transformation decreases with the speed of this transformation. Very rapid martensitic transformation might increase the diffusion speed to the extent that C is eliminated from solid solution with the formation of Fe_3C. (5e)

5f. Nitriding

Strength of Nitrided Steels under Tension-compression Loading. N. V. PINES. *Metallurg*, Vol. 11, Sept. 1936, pages 51-58. In Russian. Steel containing 0.32% C, 0.22 Mo and 0.96 Al was nitrided in two temperature ranges, 480-490° C. and 570-580° C. to Vickers hardness of 800-900 and 900-1000. The thickness of case produced was made to vary between 0.10 and 0.60 mm. The influence of nitriding on the strength not only of smooth but of notched specimens was investigated; under tension-compression loading applied in a Schenck machine running at 30,000 cycles per min., nitrided samples had a greater strength than untreated. With nitrided cases of 0.15, 0.32 and 0.52 mm. the strength obtained was 54,000, 62,000 and 67,000 lbs./in.^{2} respectively. Destruction of nitrided specimens starts under the case, in untreated always on the surface. Nitriding, owing to the notch effect, greatly reduced the impact strength; notched nitrided specimens were about 25% stronger in tension-compression testing than specimens having a smooth surface. Gradual transition zone between the core and the case is helpful under these conditions. (5f)

Nitriding. V. O. HOMERBERG. *Iron Age*, Vol. 138, Oct. 15, 1936, pages 49-52, 54, 56, 61,-62, 64, 66, 98. A detailed discussion of the development of nitriding including researches of other authorities, and some new data. Steels with Be, both ferritic and austenitic, can be precipitation-hardened and nitrided. Describes various furnaces available for nitriding. Use of suitable container materials is of paramount importance. Gives results of tests and includes a number of tables, and graphs. VSP (5f)

Internal Stresses Produced after Nitriding. I. E. KANTOROVICH. *Metallurg*, Vol. 11, Sept. 1936, pages 97-105. In Russian. The generally accepted viewpoint that nitriding does not introduce any internal stresses was checked by nitriding large diameter thin-walled rings. The difference in expansion coefficient between nitrided and original Fe is quite pronounced resulting in tangential stresses up to 37,000 lbs./in.^{2} (5f)

Penetration of Nitrogen into Ferrite and Its Hardening Effect (Sur la Mode de Pénétration de l'Azote dans la Ferrite et sur son Effet Durcissant) HENRY DE RYCKER. *Revue de Métallurgie*, Vol. 33, Oct., 1936, pages 585-587. Hardening produced by nitriding is related not to the formation of nitride crystals, but to the penetration of N atoms within Fe space lattice. In properly nitrided specimens there should be no nitride needles. They are formed because nitriding temperature usually fluctuates, causing supersaturation and precipitation of nitride needles. N penetrates originally along grain boundaries diffusing from them into body of crystals. JDG (5f)

The Heat of Formation and the Free Energy of Formation of Boron Nitride. SHUN-ICHI SATOH. *Scientific Papers Institute of Physical & Chemical Research*, Tokyo, Vol. 29, May 1936, pages 53-62. In English. See *Metals & Alloys*, Vol. 7, May 1936, page MA 233R/5. WH (5f)

6. FURNACES, REFRACTORIES AND FUELS

M. H. MAWHINNEY, SECTION EDITOR

Recent Developments in the Production of Magnesite Refractories. L. LITINSKY. *Brick and Clay Journal,* Vol. 89, Nov. 1936, pages 212-218. Translation and summary of *Ber. Deut. Keram. Ges,* Vol. 16, 1935, pages 565-596. Improved properties of magnesite brick are leading to new applications. Among the uses are nozzles and stoppers in steel industry; in Cu, Pb, and Zn plants; in paper industry; in electrical heating because of low electrical conductivity of MgO at high temperatures; in thermit welding; as tuyeres in bottoms of basic Bessemer converters. Physical properties of new magnesite refractories and de-limed dolomites are discussed. CBJ (6)

Salt-bath Furnaces. A. J. G. SMITH. *Electrical Review,* Vol. 119, Oct. 16, 1936, page 536. Describes the Kaercher type internally heated furnace, designed to prevent explosions when using salts with a KNO_3 content. Strong, welded inner bath is incased in a lighter sheet-metal covering built into the customary furnace outer casing, lined with insulating material which is extended so as to come into contact with outer covering of bath. Heating is effected by electric heating elements contained in tubes of special acid-proof material, covered with a pure Ni sheath, laid along bottom of bath and vertically at one or both ends. Should leakage occur, salts would solidify on coming in contact with insulation. Other advantages are greater life of bath and higher efficiency of furnace. MS (6)

Commercial Heat Treating Plants Process a Variety of Work. W. C. KERNAHAN. *Heat Treating and Forging,* Vol. 22, Nov. 1936, pages 547-549. Describes heat treating and miscellaneous equipment of the Pittsburgh Commercial Heat Treating Co., Pittsburgh. MS (6)

2 **On the Present State of Industries Using Electric Furnaces (Sur l'état actuel des industries du four électrique)** G. FLUSIN, *Helvetia Chimica Acta,* Vol. 19, Aug. 16, 1936, pages E 69-E 77. In French. Part of this general review is devoted to the melting of metals and their oxides in electric furnaces. EF (6)

— **Laboratory Electric Furnace for Very High Temperatures (Four électrique de Laboratoire pour les Températures très élcoées)** H. GEORGE. *Revue de Fonderie Moderne,* Vol. 30, Nov. 25, 1936, pages 339-343. See *Metals and Alloys,* Vol. 6, 3 Dec. 1935, page MA 494 L/9. Ha (6)

The Baby Cupola. GUY HÉNON. *Foundry Trade Journal,* Vol. 55, Sept. 10, 1936, pages 200-202. Extended abstract of the paper published in "La Fonte." The external dimensions of the — cupola are only of small consequence if it is lined with a plastic refractory, which material the author recommends. Ring plates are used so that, when shaped, their diameter is at least 70 cm. for an internal diameter of 40 cm. For a 40 cm. cupola the 4 charge is about 100 kg. with 10 to 12 kg. of coke. The limestone charge weighs 3 to 4 kg. The author cites the example of melting the austenitic Ni-Cu-Cr-Fe "Ni-Resist" in the baby cupola. AIK (6)

— **High-Frequency Electric Melting Furnace Equipment.** *Foundry Trade Journal,* Vol. 55, Aug. 27, 1936, pages 159-162. Extracted from the *G.E.C. Journal,* Vol. 7, No. 3, 1936. An installation at the works of Jonas & Colver (Novo), Limited, is described. 5 Advantages of high-frequency melting, principles and construction of the high-frequency furnace, electrical equipment, furnace efficiency, etc., are discussed. AIK (6)

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Steel Forgings Tempered by Recirculation. C. F. CLARK. *Steel,* Vol. 99, Dec. 21, 1936, pages 41-42. Cylindrical tempering furnace is completely described. See *Metals and Alloys,* Vol. 7, Feb. 1936, page MA 58 R/5. MS (6)

High-frequency Furnaces. Electrical Review, Vol. 119, Nov. 27, 1936, page 749. Brief description of 4-ton high-frequency furnace installation for melting low-C high-alloy and stainless steels at Fried. Krupp Works, Essen, which has shown that high-frequency furnace can compare favorably with arc furnace for steel making. MS (6)

The Rating of Technical Gases as Fuels (Die brenntechnische Bewertung technischer Gase) H. BRÜCKNER & H. LÖHR. *Zeitschrift Verein deutscher Ingenieure,* Vol. 80, Oct. 17, 1936, pages 1275-1279. Combustion gases may be graded according to the "specific flame capacity," defined as the heat developed in a burner of 1 cm.^{2} section at a definite flame height, as function of the gas-air mixture. Tables for various gases are given. Ha (6)

Radiant Tube Furnace Speeds Malleablelized Castings Process. *Industrial Gas,* Vol. 15, Jan. 1937, page 19. A furnace with atmosphere control reduced the cycle from 2½-3½ days to 31 hrs. Ha (6)

Continuous Furnace Provides Special Heat Treatment for Stainless Steel. *Steel,* Vol. 99, Dec. 21, 1936, page 65. Furnace for heat treatment of automotive valves has a heating chamber about 18 ft. long, divided into a heating zone 4 ft. long and a soaking zone the remainder. High-temperature type burners fire directly into heating chamber, both over and under the work. MS (6)

Develops Pit-type Furnace Equipment for Heat Treating Rods and Wire. *Steel,* Vol. 99, Oct. 12, 1936, page 87. Detailed description of installation consisting of preheating pit, heating chamber, and cooling pit. MS (6)

Construction, Operation and Field of Application of Electrically Heated Industrial Furnaces (Aufbau, Betrieb und Verwendungsgebiete der elektrisch geheizten Industrieöfen) ERNST SCHMIDT. *Elektrotechnische Zeitschrift,* Vol. 57, Aug. 13, 1936, pages 941-943. General description. Ha (6)

Developments in Electric Heat-treatment. A. G. ROBIETTE. *Metallurgia,* Vol. 15, Dec. 1936, pages 57-60. Describes recent trends in design of British furnaces. JLG (6)

Electric Heat in the Heavy Industries (Elektrowärme in der Schwerindustrie) F. KNOOPS. *Elektrotechnische Zeitschrift,* Vol. 57, Oct. 1, 1936, pages 1145-1148. General description of furnaces. Ha (6)

Electric Hardening and Annealing Furnaces (Elektrische Häte- und Vergütungsofen) *Zeitschrift Verein deutscher Ingenieure,* Vol. 80, Oct. 3, 1936, pages 1225-1227. General description with operating data. Ha (6)

Coal Characteristics Determine Economical Choice. ZUCE KOGAN. *Power Plant Engineering,* Vol. 40, Dec. 1936, page 687. The use of coal of higher B.T.U. value with limited pulverizing equipment saved $18,000 a year. ECK (6)

A Few Principles of Electric Furnace Construction (Einige Grundfragen des Elektroofenbaues) WILHELM FISCHER. *Elektrotechnische Zeitschrift,* Vol. 57, Oct. 1, 1936, pages 1139-1144. Resistor materials, space considerations and design features are discussed. **Ha (6)**

Properties and Uses of Mullite Refractories. M. L. FREED. *Industrial Heating,* Vol. 4, Jan. 1937, pages 57-62. Properties required of refractories are discussed, and the successful application of mullite in furnaces at temperatures higher than 3000° F., under heavy loads and exposed to extreme spalling conditions, is described. Ha (6)

Blast Furnace and Coke Oven Operators Meet in Chicago. *Blast Furnace and Steel Plant,* Vol. 24, Nov. 1936, pages 969-971. **Operators Endorse Coke Crushing and Screening. Steel,** Vol. 99, Oct. 1936, pages 76-77. Summarizes discussions on blast furnace coke held at a joint meeting of the Chicago District Blast Furnace and Coke Oven Association and the Eastern States Blast Furnace and Coke Oven Association. Majority of operators endorsed crushing and screening of coke. There is considerable variation in practice at different plants with regard to physical testing of coke and correlation with blast-furnace operation. There appears to be no difference in products of wide and narrow ovens. MS (6)

7. JOINING

Shrink Fit and Fatigue Strength. HUBERT HAUTTMANN. *Mechanical World & Engineering Record,* Vol. 99, Jan. 24, 1936, pages 81-82. Fatigue studies revealed that shrinking as ordinarily practiced can be detrimental to the shaft life, and the latest method for completely avoiding this difficulty is described. WH (7)

Welding Practices in the Metal Mining Industry. WASS. *Canadian Mining Journal,* Vol. 58, Jan. 1937, pages 14-17. A review. Welded structural work costs about 20% less on the average than riveted work of the same character. WHB (7)

7a. Soldering & Brazing

C. H. CHATFIELD, SECTION EDITOR

Furnace-Brazed Joints and How to Design Them. B. W. GONSER. *Product Engineering,* Vol. 7, Dec. 1936, pages 444-447. The practice of making Cu-brazed joints in a furnace is described whereby the unit parts are merely held together, the brazing material is placed at the joint to be made, and the whole is heated in a suitable atmosphere in a furnace to a temperature above the melting point of the brazing material. Fields of application, and technical data on design of joints are given. Ha (7a)

New Uses of Electric-furnace Brazing Process. H. M. WEBBER. *General Electric Review,* Vol. 39, Aug. 1936, pages 381-387. Electric brazing has taken its place with torch brazing, dip brazing, soft soldering, welding, riveting, pinning, casting, forging and machining from solid stock as a fabrication method. This method provides strength, long life, and a clean finished surface of the product. Automobile, refrigeration parts and many other metal products are thus fabricated. Types of brazing furnaces used include: (1) box or batch type; (2) mesh-belt conveyor type; and (3) roller-hearth type. CBJ (7a)

7b. Welding & Cutting

E. V. DAVID, SECTION EDITOR

Self-sharpening Cutting Blades. *Mechanical World & Engineering Record,* Vol. 100, Sept. 11, 1936, pages 245-246. Certain types of cutting blades are faced with a hard material in such a way that the difference in wear resistance between the facing and the core aids in maintaining a sharp cutting edge. WH (7b)

Welding of Rails. M. MICHAUD. *Mechanical World & Engineering Record,* Vol. 100, July 24, 1936, pages 76, 88. Based on a paper presented before the 12th International Acetylene Congress; the advantages offered by oxy-acetylene welding of rails are pointed out. See *Metals and Alloys,* Vol. 7, Oct. 1936, page MA 499L/7. WH (7b)

Precautions in Welding Light-Metal Profiles (Beobachtungen beim Schweissen von Leichtmetall-Profilen) M. MAIER. *Aluminium,* Vol. 18, Nov. 1936, pages 537-541. Incorrect welding procedure is claimed to be the cause of the frequently observed tendency to crack of welds of Al alloys containing small amounts of Mg and Si. Satisfactory welds can be produced using a welding rod of the same composition as the alloy if the weld is well heated throughout and subsequently stress-relief annealed. Less likelihood of cracking results, however, if an Al rod containing 4% Si be used. Ha (7b)

The Successful Welding of Cast Iron Machine Parts (Ueberlegungen und Massnahmen zur erfolgreichen Schweissung gusseiserner Maschinenteile) K. KOHRS. *Autogene Metallbearbeitung,* Vol. 29, Nov. 1, 1936, pages 321-332. Procedures used and precautions to be taken, particularly the proper positioning of the piece, selection of rod of correct composition to replace elements burnt away in welding, surface preparation and ultimate heat treatment of the weld are discussed and illustrated by a large number of examples. Ha (7b)

Welding Cast Iron with Monel Metal. *Mechanical World & Engineering Record,* Vol. 99, May 22, 1936, page 515. Welding job described refers to completely fractured body of large press reconditioned by use of Monel metal electrodes. WH (7b)

The Electric Welding of Lead. T. ŌKAMOTO, H. NISHIMURA & I. ONISHI. *Yosetsu-kyokwai-shi,* Vol. 6, July, 1936, pages 256-261. In Japanese. Pb can easily be welded either by the electric arc or by the resistance welding process. Pb plates were arc welded by the ordinary d.c. metallic arc process with or without the flux and also by the d.c. or a.c. carbon arc process, and the mechanical properties of the joints, the corrosion resistance towards H_2SO_4 and various other properties of the deposited metal were tested and found very satisfactory. Pb plates were also easily resistance spot welded with good results. Bars and plates can successfully be welded by the ordinary resistance butt welding if proper attention is paid to the current, the pressure and the time. The plates can be welded by the electric arc process with greater speed and economy than by the gas and other welding processes. HN (7b)

The Handling, Storage and Proper Control of Compressed Gas Cylinders. F. R. FETHERSTON. *Welding Engineer,* Vol. 21, July 1936, pages 40-41. Precautions detailed to prevent abuse of cylinders. WB (7b)

Armstrong Does a Corking Good Job. R. WINSLOW. *Industry and Welding, Third Quarter,* 1936, pages 86-88. Construction and repair by welding in Armstrong Cork Co. plants is discussed. Repair of castings, welding of cracks on rolls, pipe lines are maintenance problems solved by welding. In construction of machines the parts are normalized after machining to minimize welding distortion. WB (7b)

Building Welded River Craft. EDWARD H. SYKES. *The Welding Engineer,* Vol. 21, Sept. 1936, pages 46-47. Welding is favored for construction of coal barges and towboats plying in Pittsburgh district. WB (7b)

Welding of Cylinder Blocks by Autogenous Welding (Schweissen von Zylinderblöcken durch Geschmelzschweissung) F. WUTTKE. *Autogene Metallbearbeitung,* Vol. 29, Nov. 15, 1936, pages 342-343. Describes a few examples of cold and half-warm weldings. To obtain good welds all impurities in the molten weld must be removed. Ha (7b)

The Jointing of Materials by Welding. R. H. DOBSON & R. F. TAYLOR. *Journal Royal Aeronautical Society,* Vol. 40, Sept. 1936, pages 647-657; discussion, pages 657-662. Riveting and bolting suffer by comparison with welding because the first two are (1) expensive, especially for thin sheet structures (2) space-limited in thin sheet because of liability of tearing, (3) frequent necessity of reaming, (4) possibility of fatigue cracks beginning at sharp edge of a rivet hole. Advantages of welding are cited as economy, availability of labor, serviceability, simplification of design and clerical work, and greater structural rigidity. Oxy-acetylene and electrical resistance welding are discussed. Cracking and distortion of welds are caused by volume changes and methods of reducing the number and extent of such changes during production are given. Of the aircraft materials that are used in welded structures, carbon and low alloy steels, stainless steels, Al and its alloys, and Mg alloys, are discussed. FPP (7b)

Resistance Welding—VI. L. H. FROST. *Welding Engineer,* Vol. 21, June 1936, pages 44-46. Welding of coated and electroplated sheet steel and non-ferrous material. WB (7b)

The Oxy-Acetylene Industry on the Golden Reef. O. GRAFTON & G. MAGUIRE. *Welding Journal (London),* Vol. 33, July-Aug. 1936, pages 206-210. (Presented at Twelfth International Congress Acetylene, Oxy-Acetylene Welding and Allied Industries, London 1936). A survey of oxy-acetylene industry in gold-mining region of Witwatersrand, Africa. The uses of O_2 and dissolved acetylene for cutting, welding and repairing are reviewed. WB (7b)

Welding Design. CHARLES H. JENNINGS. *Welding Journal,* N. Y., Vol. 15, Oct. 1936, pages 58-70. Fundamental factors governing satisfactory design, methods of calculating weld stresses and correct working stresses to employ for different types of joints are discussed with sketches, diagrams, tabular data and engineering formulas. Butt and fillet welds, with theoretical and practical aspects of stress concentrations resulting from discontinuities in form, fabrication difficulties, welding costs and distortion problems, are considered. Bibliography given. WB (7b)

Automatic Continuous Arc Welder Employs Tape Coated Welding Rods. *Iron Age,* Vol. 138, Nov. 5, 1936, pages 58-59. Describes a new development in arc welding by use of shielded arc in automatic arc welding with a metal arc welding head and automatic coating of welding rods with a flux tape. New method may be used for fillet, butt, lap and groove welds, and for single and multiple heads and for light or heavy material. VSP (7b)

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Electrodes
FOR QUALITY WELDING

A Study of the Widmanstaetten Structure in Welds. Part II. N. T. BELAIEW & D. SEFERIAN. *The Welder,* Vol. 8, Sept. 1936, pages 1079-1082, 1084. Discussion in text with micros and microhardness tests shown for W-structures formation with Mn, Cr-Mn, Cr-Mn-Ni, Cr-Mo (0.28C) and Cr-Mo (0.51C) steels. Only the Cr-Mo steels showed W-structure at junction line of bead and base metal. The Cr-Mn and Cr-Mn-Ni steels showed troosto-martensite in micro and Mn steel showed martensite. The W-structure is considered to cause brittleness in welds and data is given comparing impact values of material prepared having W-structure with hardened and tempered material, below:

Composition		W-Structure	Hardened at 850° C. Tempered at 700° C.
C	Mn	ft. lbs.	ft. lbs.
0.17	0.65	52.8	151.8 ft.
0.22	0.71	76.6	150.0
0.32	0.56	43.4	94.0

Impact tests (Charpy) on all weld samples were made (a) on welds as made, (b) as annealed by re-run on reverse side, (c) as reheated to 850° C. and furnace cooled, all materials being the same for each condition.

Sample No.	(a) W-Structure	(b) Partially destroyed W-Structure	(c) W-Structure destroyed
2	23.1 ft. lbs.	67.9	128.7
3	17.0 ft. lbs.	72.3	109.9
4	20.2 ft. lbs.	52.0	105.6

Conclusions are that W-structure is fairly stable and is not destroyed by simple anneal such as given in re-run of weld on reverse side but requires a full anneal to destroy the structure and bring up impact values. Arc welding is less prone to development of W-structure while thermal conditions in torch welding are especially favorable to its formation. The W-structure can be formed from an initially liquid state (weld) or in overheated parent metal. Inter-lamellar distance in W-structure is less than mean value for pearlite in heat-treated steel and two types are recognized, sorbitic W-structure, pearlitic W-structure, increase in C favors the first. Modification of welding procedure or heat treatment can eliminate the brittle W-structure. W-structure from initially liquid state (weld) and of pearlite type has higher degree of stability and normalizing is recommended for destroying the structure. WB (7b)

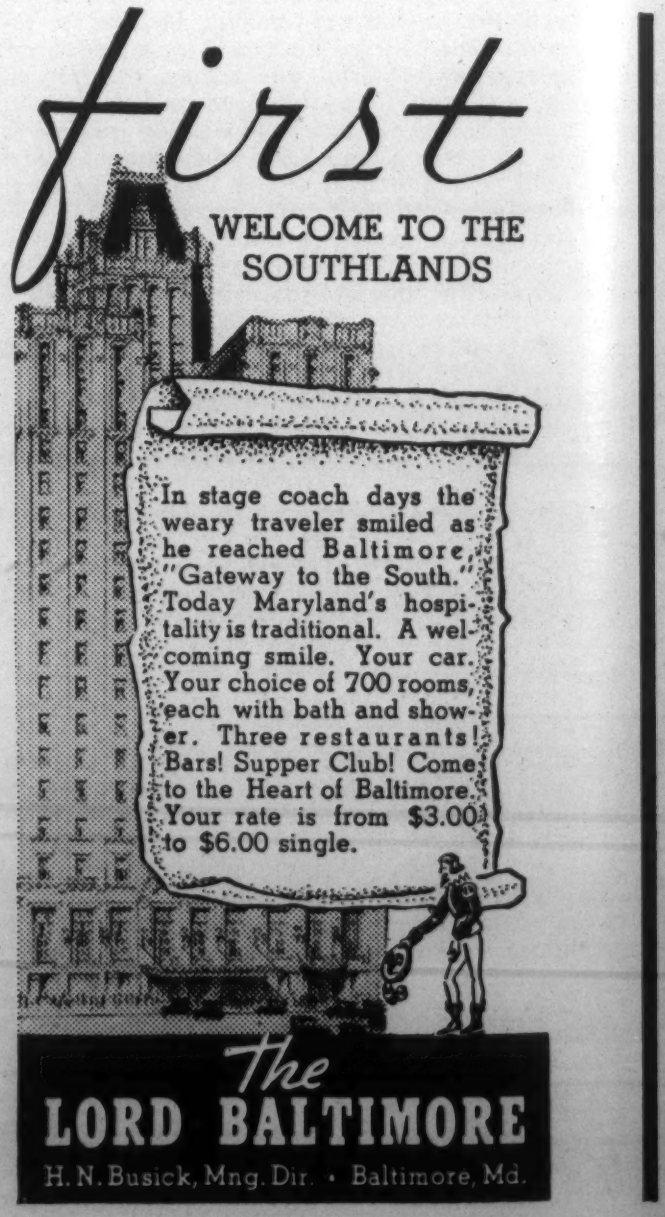
Metallurgical Aspects of the Welding of Steel. E. S. DAVENPORT & R. H. ABORN. *Welding Journal, N. Y.,* Vol. 15, Oct. 1936, pages 21-31. Discussion of physical-chemical transformations in molten weld metal on cooling of the weld and in the parent metal due to thermal cycle of heating and cooling. The changes are divided into 5 groups depending upon max. temperature reached; zone 1 is cast metal resulting from molten weld, zone 2 $\delta \rightarrow \gamma$ transition zone, mushy parent metal brought to incipient fusion, zone 3 overheated parent metal above A_3 in granulation zone where grain growth is appreciable, zone 4 between A_1 and A_3 the usual $\gamma \rightarrow \alpha$ transition zone of commercial grain-refining heat treatment, zone 5, below A_1 where carbide only is affected. In eutectoid steel zone 4 is absent but both in hypo- and hypereutectoid steels the 5 zones appear. Factors affecting structure are discussed as (1) composition and initial state of the parent metal, (2) rate of heating, (3) max. temperature attained and time interval at this temperature, (4) rate of cooling. The influence of these factors on resulting structures of material in zones 1 to 5 is detailed with the support of micros and quenching curves. Dimensional changes during contraction on cooling lead to distortion and warping if unhindered and when hindered, considerable internal stress may be locked in weld and will require subsequent treatment for severe service. Heat treatments after welding are recommended rather than peening and are detailed as (1) unintentional, and due to subsequent bead of multiple-pass weld, (2) intentional heat treatment of completed welds (a) stress-relief annealing, (b) full annealing or normalizing. For alloy steels where martensite is formed the use of preheat is recommended either locally or completely and where preheat is not used the martensite should be tempered at 1100-1200° F. before structure has cooled to room temperature. A discussion of δ phase and peritectic reaction in zone 1 is appended. WB (7b)

Sheffield Double Frame Welded 5 ft. 6 in. Gauge Passengers Bogies for the Bengal-Nagpur Railway, *The Welder,* Vol. 8, Oct. 1936, pages 1107-1108. Details described, photos to illustrate construction of frame. WB (7b)

Milwaukee Road Builds All-Welded Rolling Stock of Low Alloy Steel. *The Welding Engineer,* Vol. 21, Sept. 1936, pages 30-33. New railway cars built of Cor-Ten sheet and sections weigh 90,000 lbs. as compared with 112,000 lbs. for cars built in 1934, and with 150,000 lbs. for old style passenger coach. Fabrication methods, including riveting, spot and fusion welding, joining of castings and rolled sections are discussed and illustrated in photos of various stages of construction. WB (7b)

An Exploration of a Modern Welding Arc. L. J. LARSON. *Welding Journal, N. Y.,* Vol. 15, Oct. 1936, pages 14-20. Experiments are described which indicate that transfer of metal from coated rod in arc welding takes place as a spray of molten metal drops at a speed of 4-16 ft./sec. with 9 ft./sec. average. Vapor in the arc moves at speed of 30-80 ft./sec. with 47 ft./sec. average, determined as a minimum vapor velocity. Some smaller drops of metal are ejected from the end of the arcing electrode at speed of 128 ft./sec. initial velocities for the smaller particles. The products of decomposition of a rod coating composed of cellulose and Na silicate binder when the rod is used for arc welding were determined as 1.9 cc. of CO_2, 70.3 cc. of CO, 85.4 cc. of H_2, 9.3 cc. of H_2O from 1.0 cm. length of coated rod which is equivalent to .5 cc. of the rod. It is estimated that these gases travel with a speed of 100 ft./sec. and they are highly reducing thus protecting metal in arc and molten pool in weld from oxidation. Higher voltage of coated rod than for bare rod in air is attributed to H_2-CO atmosphere surrounding the rod since tests are reported which indicate higher operating voltage required for arc in H_2 and in CO. The greater energy in the arc of the coated rod appears as heat, the deposited metal is at a higher temperature than for bare rod arc and as a consequence greater penetration into base metal is obtained. Greater fluidity of metal pool makes possible more thorough removal of slag and impurities. Higher temperature also promotes refinement of lower beads in multiple pass welding. Comparisons are given of micros and macros of bare and coated rod welds, chemical analyses of both bare and coated rod welds as compared with plate, gas analyses (O_2 and N_2) by vacuum fusion method and physical properties comparisons. The indications are that C, Mn, Si in weld of coated rod may be matched as nearly as desired to plate material and that for bare wire weld these are burned out to a large extent. N_2 absorption in coated rod weld is reduced to non-embrittling value while bare wire weld is high in both O_2 and N_2 giving a dirty, brittle weld material. Low impact for latter, 1-2 ft. lbs. (Charpy) as against 35 for coated rod weld and 20 for plate material. WB (7b)

Applying Low-Alloy Steels to Pressure-Vessel Construction. LOUIS J. LARSON. *Welding Engineer,* Vol. 21, July 1936, pages 22-24. Discussion of welding of 4-6% Cr steel, and 2½% Ni steel and tabular data on other steels giving plate and weld properties. WB (7b)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Welding Supplements Rivets in University of Arizona Buildings. J. C. COYLE. *The Welding Engineer,* Vol. 21, Oct. 1936, pages 34-35. Review. WB (7b)

Applications of Welding at the Works of Messrs. Newton Chambers, Ltd., Thorncliffe, Sheffield. *The Welder,* Vol. 8, Oct. 1936, pages 1093-1097. Welding production department of formerly exclusively castings plant is discussed and illustrated. A variety of large tanks, benzole recovery plants, boilers, cars, excavators, etc. are fabricated by welding, some of which are illustrated. WB (7b)

Welded Chimneys at the Hull Corporation Electricity Works. *The Welder,* Vol. 8, Oct. 1936, page 1113. Chimneys are 7½ ft. dia., 110 ft. length, top is 200 ft. from ground level. WB (7b)

Welding of Wrought Iron. B. D. LANDES. *Power Plant Engineering,* Vol. 40, Nov. 1936, pages 626-629. The results of work done by the National Weld Testing Bureau, The American Bureau of Shipping and Lloyd's Register of Shipping to produce consistently good welds when welding wrought iron. The best oxy-acetylene welds are produced when perfect fusion is obtained without excessive mixing of the parent metal with the weld metal, using a high quality low C rod. Electric welding is the same as above using a lower current and speed than would be used on mild steel. Care must be taken to prevent excessive slag entering the weld. ECK (7b)

Impact Tests of Welded Joints. *Welding Journal (London),* Vol. 33, July-Aug. 1936, page 216. Review of article by W. Spraragen and G. E. Claussen with above title in *Welding Journal (N. Y.)* See *Metals and Alloys,* Vol. 7, Sept. 1936, page MA 450R/8. WB (7b)

Welded Structural Brackets. CYRIL D. JENSEN. *Welding Journal, N. Y.,* Vol. 15, Oct. 1936, Supplement pages 9-15. Discussion of design problem investigated by means of celluloid models and on welded brackets tested to destruction. Stress analysis from celluloid models is discussed and illustrated. Load tests on welded brackets indicate that the designs were satisfactory. WB (7b)

Welding Alloy Steels. A. B. KINZEL. *Welding Journal N. Y.,* Vol. 15, Oct. 1936, pages 76-78. Review of weldability of high strength low alloy steels with Cr, Mn, Ni or in combination with Si, V, Mo, P, Cu with C at 0.14 for 75,000 lbs./in.² and C at 0.22 for 90,000 lbs./in.² Air hardening in transition zone considered low enough for good weldability when C is less than 0.14. European practice is to discourage use of 90,000 lb. material for general structural work. Gas and arc welding are discussed as to the effect of the temperature gradient produced by the process in lowering critical temperature and increasing hardening. It is considered that gas welding produces lower hardening because of the lower temperature gradient in transition zone. Butt joint in 75,000 lb. steel gas welded is satisfactory in all cases, but for arc weld it may in some cases be necessary to stress relieve. The fillet joint is under stress by both methods and requires stress relief. Use of the higher strength, 90,000 lb./in.² material requires discretion in welding and in stress relief which is necessary in all cases for this grade. Welding of plain C and low alloy steels with austenitic rod is discussed, and shown to have advantage in lower internal stresses. Use of Cb for 18-8 welding is detailed. WB (7b)

"Metal Carpentry" Facilitates Building of Intricate Machinery. G. H. KOVEN. *The Welding Engineer,* Vol. 21, Nov. 1936, pages 21-22. Metal carpentry is word coined as substitute for built-up-welded-construction and indicates flexibility of weld design over foundry practice requirements of patterns, etc., which make frequent changes in design costly. Metal carpentered job practically eliminates delicate machining required for cast assembly since plate has smooth surface, supports, etc., can be welded on with accurate fitting, and cutting of exactly located openings is done with torch. Smooth surfaced, carpentered units are easily painted to prevent accumulation of dust. WB (7b)

Hard Facing More Serviceable Than Ever. *Engineering & Mining Journal,* Nov. 1936, pages 568-569. This welding process adds to the life of wearing parts. Instances of prolonged life are indicated for a scraper blade, rabble disks and stripping knives of Co-Cr-W alloy for removal of cathode starting sheets in electrolytic Cu refineries. WHB (7b)

Reducing Wear and Corrosion by Surface Treatment. MILES C. SMITH. *Welding Engineer,* Vol. 21, July 1936, pages 36-37. Brief review of hard surfacing with Colmonoy, boride crystals. WB (7b)

A bronze spud, used in making pipe connections, was brazed to a copper sheet with SIL-FOS. The finished joint was then battered with a heavy hammer, squeezed in a powerful vise, sharp bends were made right at the joint—with the results shown in the unretouched photographs above.

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8. FINISHING

H. S. RAWDON, SECTION EDITOR

Metal Cooling Advances in 1935 revealed by the German Patent Literature (Fortschritte der Metallüberzugstechnik im Jahre 1935 an Hand der deutschen Patentlieraur) K. NISCHK. *Oberflächentechnik,* Vol. 13, Nov. 17, 1936, pages 253-255; Dec. 1, 1936, pages 267-268. Recently developed methods of cleaning and degreasing, pickling, Cr- and Co-plating, plating on Al, anodic treatment of Al and Zn, and metal-coatings by diffusion are reviewed. Ha (8)

Need for Universally Standardized Testing Methods for Metal Coatings (Notwendigkeit allgemeiner systematischer Prüfungen der Metallüberzüge) GEORG BUCHNER. *Chemiker Zeitung,* Vol. 60, June, 1936, pages 497-498. Whether the metal-coating be produced by electroplating or hot-dipping, standardization of testing methods is a most urgent desideratum. Types of coatings are briefly discussed and methods of evaluation are discussed first, as works and laboratory procedures, and then as physico-chemical, macroscopic, mechanical, chemico-analytic, and corrosion and heat-resisting methods. FPP (8)

8a. Pickling

Pickling Plant Equipment of Greater Durability (Beizereieinrichtungen von hoher Lebensdauer) *Die Beizerei (Supplement to Emailwaren-Industrie),* Vol. 1, Oct. 29, 1936, pages 13-15. A discussion of the corrosion resistance of Monel metal. RAW (8a)

Another closely related article is abstracted as follows: **Anodic Pickling of Iron and Steel.** R. MÜLLER & L. HARANT. *The Electrochemical Society Preprint* 69-28, pages 315-323. Presented April 1936. In electrolytic pickling the work to be cleaned is made the anode. The electrolyte may be an acidified salt solution. The electrolytic method has the advantage over acid pickling in that H_2 embrittlement will not occur. The cost of straight acid pickling at a German plant is said to be .3c/m.^{2} The electrolytic method seldom requires a change of electrolyte and is said therefore to be cheaper. Current cost is taken at .1c/m.^{2} The method suggested involves an electrolyte of .4 *N* $FeSO_4$ plus .1 to .5% H_2SO_4. Temp. 25° to 35° C., current density 4.6 to 9.3 amps./ft.^{2}; Fe cathodes; pickling time 30 min. GBH (8a)

Cleansing Automobile Forgings. *Automobile Engineer,* Vol. 26, June 1936, pages 245-246. Forgings and castings are pickled in steel tanks lined with a rubber composition, the pieces being suspended on Monel metal hangers. The treatment takes 75 minutes and reveals any surface cracks and defects. Ha (8a)

8b. Cleaning including Sand Blasting

Cleaning Steel—Chemically. RICHARD L. DAVIES. *Chemical and Metallurgical Engineering,* Vol. 43, Nov. 1936, page 606. For heavy-duty cleaning operations of steel, solutions of anhydrous sodium orthosilicate (Na_4SiO_4) are effective. Solutions of various alkaline salts at a concentration of 3% (4 oz./gal.) and at 200°F. showed that Na_4SiO_4 had a relative conductivity of 10.05 amps. compared with 3.9 for Na_2CO_3, 3.25 for $Na_2SiO_35H_2O$ and 2.52 for Na_3PO_4. The amperage was measured between 2 steel plates 2″ wide, immersed 6″ deep, 4″ apart, at a constant potential of 6 v. pH values were observed as follows: Na_2Co_3 11.9; Na_3PO_4 12.3; Na_2SiO_3 12.8; $Na_6Si_2O_7$ 13.3 and Na_4SiO_4 13.5. PRK (8b)

Power and Air Consumption of Sandblast Nozzles (Kraft-und Luftverbrauch von Sandstrahldüsen) P. NETTMANN. *Automobiltechnische Zeitschrift,* Vol. 39, Nov. 10, 1936, pages 554-555. Curves showing the relation between power consumed, volume of air and air pressure, and hints for selecting nozzle material are given. Ha (8b)

Metal Cleaning Agents (Die Metallreinungsmittel) ADOLF VOIGT. *Oberflächentechnik,* Vol. 13, Nov. 17, 1936, pages 255-256. General review of different types and properties of cleaning agents for mechanical and chemical cleaning of metal surfaces. Ha (8b)

8c. Polishing & Grinding

Determination of the Operating Value of Different Grinding Materials in Comparison with the Diamond (Ermittlung des Arbeitswertes verschiedener Schleifmittel im Vergleich zu Diamant) W. DAWIHL, K. SCHROTER & M. STOCKMAYER. *Zeitschrift Verein Deutscher Ingenieure,* Vol. 80, Aug. 15, 1936, pages 1001-1003. Drawing dies of diamond are so superior to those of B_4C, SiC and B that only the diamond is economically applicable. Hardness definition can be given only in connection with a definite application and material. Ha (8c)

Polishing Rustless Steels. A. M. PORTEVIN & R. CASTRO. *Iron & Coal Trades Review,* Vol. 133, Oct. 2, 1936, page 574. Inclusions in steel affect the quality of the polish by their number, size and distribution, and nature. The characteristics of different types of inclusions in the usual stainless steels are tabulated. The inclusions most detrimental to a good polish are Al_2O_3, silico-aluminates or aluminates, and the nitrides of Ti; the least harmful inclusions are oxysulphides and sulphides, chromous oxide, chromite, etc. The effects consist in reducing the hardness and the reflecting power of the polished surface, and in causing brittleness. Ha (8c)

8d. Electroplating

Commercial Copper Cyanides for Electroplating Purposes. E. E. HALLS. *Sheet Metal Industries,* Vol. 10, Nov. 1936, pages 881-882. A general discussion of CN baths using either single salts, $Cu(CN)_2$, or double cyanides, $NaCu(CN)_2$. AWM (8d)

The Roentgenographic Study of Zinc and Cadmium Films Deposited in the Presence of Colloids. L. PALATNIK. *Transactions of the Faraday Society,* Vol. 32, June 1936, pages 939-941. During the electrodeposition of Zn and Cd in the presence of colloids, of dextrin, sulphonated castor oil and cereal extracts, a texture is observed although imperfect, particularly for Zn. For Zn the (221) planes tended to lie parallel to the surface. The degree of orientation of crystals depends on the concentration of colloids as well as on the current density. The relative intensity of the Debye-gram lines for Zn and Cd films undergoes a sharp change depending on the concentration of the colloid. Colloids promote the growth of crystals in a single crystallographic direction, perpendicular to the surface of the cathode. 4 references. PRK (8d)

The Electrochemical Protection of Iron and Steel Against Corrosion. COLIN G. FINK. *Helvetia Chimica Acta,* Vol. 19, Aug. 16, 1936, pages E 59- E 68. In English. After considering coatings of Ni, Co, Ni-Co alloy, Cu, Cr, Zn, Cd, Sn, electrodeposition of H, miscellaneous electrocoatings, heat treating electrodeposits, anidoc processes, testing methods and relative merits of electrodeposits, the author discusses the recent trend toward the use of electrodeposited coatings for protective rather than decorative purposes, and on larger parts and equipment than formerly. EF (8d)

Application of the "Skin" Effect for the Investigation of Thin Metallic Layers (Anwendung des "Skin"-Effektes zur Untersuchung dünner metallischer Schichten) J. GOLDFELD & N. I. KOBOSER. *Acta Physicochimica USSR,* Vol. 5, No. 2, 1936, pages 243-270. In German. A new testing method based on the skin effect involving the measurement of the high frequency resistance has been worked out for the investigation of thin metallic layers (electrolytically deposited) upon a metal base. The properties of Fe coatings on Pt and Ag and of Zn on Fe were investigated. The variables time, thickness of deposit, current density and temperature were studied. The testing method was found to be useful for the investigation of the kinetics of the crystallization process. The annealing tests are interpreted on the basis of alloy formation at the interface of both metals and their upper limit of diffusion speeds is calculated. EF (8d)

Improvements in Bath and Deposits Increase Use of Black Nickel Plate. C. B. F. YOUNG. *Steel,* Vol. 99, Aug. 10, 1936, pages 40,42-43. Commercially satisfactory black Ni baths are neutral or slightly acid and contain 8 oz. $NiSO_4.(NH_4)_2SO_4$, 1 oz. $ZnSO_4$, and 2 oz. NaCNS per gal. Composition of black Ni deposits is 40-60% Ni, 20-30% Zn, 10-14% S, and 10+% organic matter. Between 0.5 and 1.5 volts should be used. Current-density should not exceed 2 amps./ft.^{2} Ni or Ni and C anodes are used. Baths are operated at room temperature. pH should be from 5.5 to 6.0. While black Ni may be applied directly on steel, it is general practice to deposit a preliminary coating of another metal. MS (8d)

Brass Plating Prepares Surfaces to Receive Heavy Coating of Rubber. *Steel,* Vol. 99, Sept. 7, 1936, pages 49-50. Describes practice of Firestone Steel Products Co. in manufacture of automotive parts. In fabrication, only drawing compounds which can be removed satisfactorily in an alkali-cleaner are used. Parts are cleaned electrolytically in solution of NaOH and Na_2CO_3 at 210° F., pickled in H_2SO_4, rinsed in cold H_2O, stripped in solution of NaCN and NaOH, and plated in a bath containing 3.6-4.6 oz. NaCN, 2.5-3.0 oz. $Cu(CN)_2$, and 1.25-2.0 oz. $Zn(CN)_2$ per gal. pH is about 10.5 and must be held between 10.3 and 10.7. Anodes (a cast 70-30 alpha brass) must be pure. Tank voltage of 3 volts and current-density of 8-12 amps./ft.^{2} are used. Plate thickness is 0.00002 in. After plating, parts are rinsed, dried, and covered with a cumar resin. MS (8d)

Electroplating Lead. P. P. BELJAEV & J. B. GUREVICH. *Zhurnal Khimicheskoy Promishlentosti,* Vol. 13, 1936, pages 602-605. In Russian. Description of the commercial process using fluosilicate bath. NA (8d)

8e. Metallic Coatings other than Electroplating

Modern Electrochemical Methods to Protect Metallic Surfaces, their Chemical and Physico-chemical Principles (Moderne elektrochemische Verfahren zum Schutz metallischer oberflächen, ihre chemischen und physikalisch-chemischen Grundlagen) HELLMUT FISCHER. *Angewandte Chemie,* Vol. 49, July 25, 1936, pages 493-498. Recent developments, especially for protection of light metals by metallic and oxide films are reviewed and their production is described. 19 references. Ha (8e)

Theoretical Principles of Hot Galvanizing (Theoretische Grundlagen der Feuerverzinkung) H. GRUBITSCH. *Berg- und Hüttenmännisches Jahrbuch,* Vol. 84, Aug. 28, 1936, pages 47-54. Merits of hot galvanizing as protection against corrosion are compared with those of other Zn-coating methods; the greatest advantage is that the thickness of the coatings can be varied within wide limits and that they are almost free of pores while their lack of ductility on bending is a drawback. Operations necessary for successful galvanizing are discussed, especially pickling and inhibitors. Fluxes are used to obtain a clean Fe surface whereby the reactions take place: Fe, FeO + flux = $FeCl_2$, $FeCl_2 + Zn = ZnCl_2 + Fe$, $Fe + Zn$ = alloy ($FeZn_7$). The amount of Fe dissolved by the flux is dependent upon the ammonium chloride and moisture content of the flux. As $FeCl_2$ also increases the amount of hard Zn (dross), the flux should contain as little ammonium chloride as possible. It is generally accepted now that 2 alloy layers are formed between Fe core and Zn cover, Fe_3Zn_{10} and $FeZn_7$ which can be distinguished by proper etching methods. Temperatures for galvanizing lie between 430° and 530° C. according to the kind of steel. An equation is given for calculating penetration depth from T, the constant temperature of the bath and t, the duration of galvanizing in hr. Conditions of structure and thickness of the Zn layer are explained and illustrated by micrographs. 43 references. Ha (8e)

Successful Metal Coating by the Spraying Process. LEOPOLD PESSEL. *The Welding Engineer,* Vol. 21, Sept. 1936, pages 48-50. Appraisal of uses where sprayed metal is an advantage for corrosion resistance and building-up. Properties such as hardness, compressive strength, corrosion resistance, heat and electrical conductivity are high for the sprayed coatings, but it is stated that tensile strength, ductility, etc., are best left out of consideration in application of metal as spray coating. Control of metal adherence is in preparation of base (roughening by blasting) and in temperature control of sprayed metal in order to prevent contraction stresses of overheated metal from rupturing bond with the base. WB (8e)

Aluminum Coatings on Iron (Aluminiumüberzüge auf Eisen) A. v. ZEERLEDER. *Korrosion & Metallschutz,* Vol. 12, Oct. 1936, pages 275-283. 45 references. See *Metals and Alloys,* Vol. 7, May 1936, page MA 246R/2. Ha (8e)

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8f. Non-Metallic Coatings

New Materials and Substitutes for Painting and Lacquering Metals (Austriche und Lackierung von Metallen im Lichte neuer Ersatzstoffe und Werkstoffe) F. OHL. *Oberflächentechnik,* Vol. 13, Nov. 3, 1936, pages 243-245. Properties and compositions of recently developed materials for surface protection are discussed. Of particular interest are the alkyde resins and the amber lacquers; the former contain phthalates, drying and non-drying oils and high-percentage phenol resins, the latter are solutions of amber (made at ordinary temperatures) which can be used on metals, concrete, and as primers. These artificial lacquers can also be hardened still further by addition of lime, zinc oxide, etc. but may become brittle. Methods and fields of application are discussed. Ha (8f)

Polychromatic Finishes. H. HAWKINS. *Automobile Engineer,* Vol. 26, June 1936, page 257. Methods for painting and spraying colored finishes and treatment of the surfaces, particularly in coach work, are briefly described. Ha (8f)

The Problem of Efficient Enameling of Light Alloy Components of The Magnesium-base Type. E. E. HALLS. *Metallurgia,* Vol. 14, Oct. 1936, pages 157-161. Describes different types of surface pre-treatments and paints and enamels suitable for Mg alloys. Results of exposure tests given. JLG (8f)

Spray-Painting as Protection for Metals (Des Spritzanstrichverfahren als Metallschutz) O. TH. KORITNIG. *Korrosion & Metallschutz,* Vol. 12, Sept. 1936, pages 241-245. Principles, types of paints and lacquers suitable for spraying, equipment, and health-protective arrangements are described. Ha (8f)

Determination of Mechanical Properties of Paint Films (Die Bestimmung der mechanischen Eigenschaften von Austrichfilmen) *Oberflächentechnik,* Vol. 13, Dec. 15, 1936, pages 277-278. An instrument to measure tensile strength, elongation and sensitivity of paint-films to different conditions of heat and light is described. Ha (8f)

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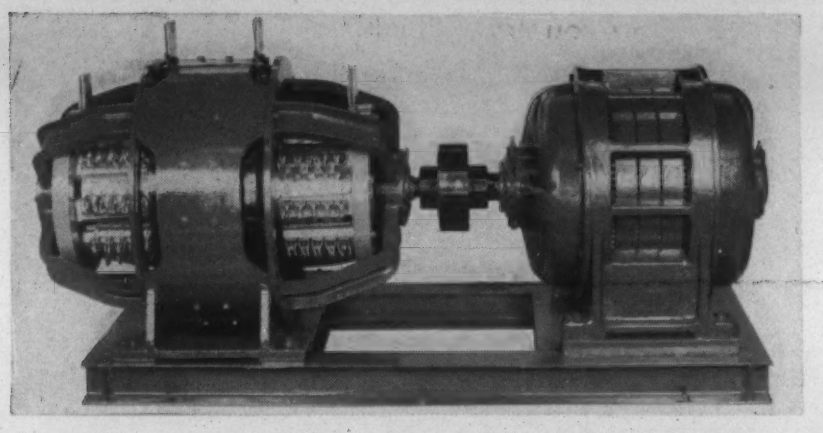

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Paints and Varnishes (Tintis e Vernices) *Revista Brasileira de Chimica,* Vol. 2, Sept. 1936, pages 154-155. A study of cellulose paints and their application to metal coating. Ha (8f)

1 **Patent Literature on the Electrolytic Oxidation of Aluminum (Die electrolytische Oxydation von Aluminium in der Patentliteratur)** K. NISCHK & F. MARKHOFF. *Metallwirtschaft,* Vol. 15, Dec. 4, 1936, pages 1170-1172; Dec. 11, 1936, pages 1196-1199. A review of the patent literature on the electrolytic oxidation of aluminum is presented in tabular form. GA (8f)

2 **Soviet-Russian Research on Non-Metallic Coatings (Sowjetrussische Forschungsarbeiten über nichtmetallische Ueberzüge)** M. v. POHL. *Korrosion & Metallschutz,* Vol. 12, Sept. 1936, pages 257-260. The present status and methods of applying bituminous materials, rubber, cellulose, paints and lacquers in the protection of metals from corrosion are discussed on the basis of the report by the 1st Conference on Metal Corrosion of the Soviet Academy of Sciences. Ha (8f)

3 **The Present Status of Composition of Paints for Rust Protection of Bridges and Steel Structures (Der gegenwärtige Stand des Farbenaufbaues für den Rostschutzanstrich von Brücken und Stahlbauwerken)** B. SCHEIFELE. *Korrosion & Metallschutz,* Vol. 12, Sept. 1936, pages 245-249. Composition of paints, pigments and binders, and recent developments in paints and painting processes are discussed. Ha (8f)

4 **Chlor-Caoutchouc (Chorinated Rubber) as Corrosion-resisting Coating (Chlorkautschuk als Schutzanstrich gegen Korrosion)** G. SCHULTZE. *Korrosion & Metallschutz,* Vol. 12, Sept. 1936, pages 249-253. Composition and properties are listed and fields of application discussed. Must be used pigmented as the transparent film is sensitive to ultraviolet rays; it can be used also as priming material. Recommended for coatings of high chemical resistance, noninflammability, and hardness. Tests are described. Ha (8f)

5 **Dipping and Baking Coils.** W. J. WALKER. *Transit Journal,* Vol. 80, Dec. 1936, page 476. Railway motor armatures and field coils should be dipped regularly. WHB (8f)

6 **Protecting Gas Holders.** W. M. BASSETT. *Gas Age Record,* Vol. 77, Feb. 22, 1936, pages 177-180. Paper presented before Operating Division, New England Gas Association, Jan. 1936. Practical review of painting gas holders with special emphasis upon cleaning and preparation of the surface. VVK (8f)

7 **Coloring of Metals. (4) Zinc and Die Castings.** HERBERT R. SIMONDS & C. B. YOUNG. *Iron Age,* Vol. 138, Sept. 3, 1936, pages 30-35, 110. Describes the few commercial methods of coloring Zn and outlines the chief research now in progress. Other features considered include electroplating of die castings and galvanized Fe, and the alloying of Zn for finish effect. See *Metals and Alloys,* Vol. 7, Dec. 1936, page MA 595R/10. VSP (8f)

8 **Researches into Phosphate Protection of Ferrous Metals (Ricerche sulla Protezione Fosfatica dei Metalli Ferrosi)** O. MACCHIA. *Industria Meccanica,* Vol. 18, Sept. 1936, pages 566-572; Oct. 1936, pages 620-623; Nov. 1936, pages 694-698. A description and discussion of 89 patents from various countries pertaining to surface treatment by phosphating processes. See *Metals and Alloys,* Vol. 8, Mar. 1937, page MA 162L/7. Ha (8f)

9 **Theoretical Principles and Practical Application of Phosphate Rust-proofing Methods (Theoretische Grundlagen und praktische Durchfuhrung der verschiedenen Phosphat-Rostschutzverfahren)** R. JUSTH. *Oberflächentechnik,* Vol. 13, Oct. 6, 1936, pages 221-224. The present industrial tendency to develop protective coatings by reactions involving the base metal itself rather than by electrolytic deposition of other metals is discussed, with emphasis on phosphate protection as described in international patent literature. See *Metals and Alloys,* Vol. 8, Feb. 1937, page MA 106L/1. Ha (8f)

10 **Mechanics of Enamel Adherence. XII. A Chemical and X-Ray Examination of Metallic Precipitates from Enamels Containing Iron and Cobalt Oxides.** R. M. KING. *Journal American Ceramic Society,* Vol. 19, Sept. 1936, pages 246-249. SiC was used as reducing agent for frits containing both Co and Fe oxides. Conclusions are: both Fe and Co are precipitated; when frit contains 50-50 Co and Fe, more Co is precipitated by the SiC; Fe-Co alloy and Co are present in precipitate, Co, Ni and α and β Mn are found in reduction of commercial ground coat frit. WB (8f)

9. TESTING

9a. Inspection & Defects, including X-Ray Inspection

C. S. BARRETT, SECTION EDITOR

Further Investigations on Plates of Old Mild Steel Boilers (Weitere Untersuchungen von Blechen alter schweisseiserner Kessel) K. DAEVES & W. RÄDEKER. *Die Wärme,* Vol. 59, Sept. 26, 1936, pages 627-634. Continuing previous investigations (see *Metals and Alloys,* Vol. 4, Apr. 1933, page MA 125 L/3) plates from boilers after 140,000-300,000 service hrs. were tested. Analysis .1-.2% Mn, .1-.33% P, tensile strength 38,000-51,000 lbs./in.^{2} Weldability: good. Corrosion defects: none. No improvement was accomplished by further heat treatment. Conclusion: the standard physical testing methods offer no absolute guarantee against failure. EF (9a)

The Influence of Stresses Normal to the Surface on X-Ray Measurements of Deformation (Der Einfluss der zu der Oberfläche normalen Spannungen auf die röntgenographisch gemessene Deformation) G. KURDJUMOW & M. SCHEIDAK. *Metallwirtschaft,* Vol. 15, Sept. 25, 1936, pages 907-908. Cylinders of 0.4 C steel, 300 mm. long and 50 mm. in diameter, were quenched from 650° into ice water. The radial plus tangential stresses in a disk 15 mm. thick, cut from the center, were measured by the mechanical and X-ray methods of Sachs with good agreement. However, it was found that with a disk 30 mm. thick the stresses normal to the surface of the disk, i.e., parallel to the axis of the cylinder, distorted the measurements for tangential and radial stresses, and that disks as much as 70 and 135 mm. thick made the values useless. GD (9a)

9b. Physical & Mechanical Testing

W. A. TUCKER, SECTION EDITOR

Significance of the Numerical Values in the Mechanical Testing of Metals (La Signification des valeurs numeriques dans les essais mecaniques des métaux) L. DELVILLE. *Métaux,* Vol. 11, July 1936, pages 140-147. General discussion of the application of dimensional terms to mechanical testing. GTM (9b)

Brinell Hardness Test (L'Essai de Dureté Brinell) *La Fonderie Belge,* Vol. 3, July-Aug. 1934, pages 109-110. Description of the "Atlas" testing machine, which is designed like a weighing scale. FR (9b)

New Hardness Testing Machines (Neuere Härteprüfer) W. HENGEMÜHLE. *Stahl und Eisen,* Vol. 56, Sept. 10, 1936, pages 1017-1025. New modifications in the Brinell, Rockwell, Vickers, Monotron Scleroscope, and duroscope hardness testers are described Graphs of the relationships between the Rockwell and Brinell, Vickers and Brinell, and the Monotron, Rockwell, scleroscope, and Brinell tests are shown. SE (9b)

Practical Application of Molding Sand Testing in Foundry Operation (Ueber praktische Anwendung der Formsandprüfung im Giessereibetrieb) *Giesserei,* Vol. 23, Aug. 28, 1936, pages 431-437. The advantages of careful testing and mixing of molding sand, according to its purpose, are stressed, and instruments and apparatus for sampling and for testing moisture content, sand content, grain size, gas permeability and strength are described. Ha (9b)

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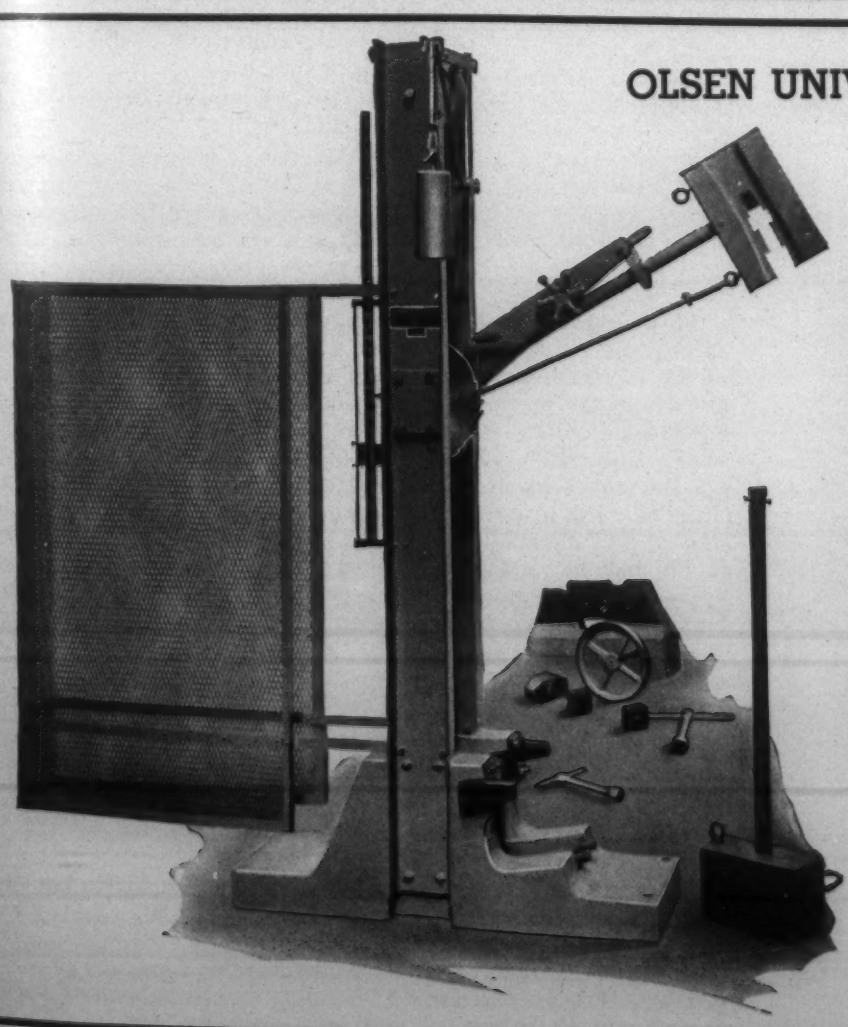

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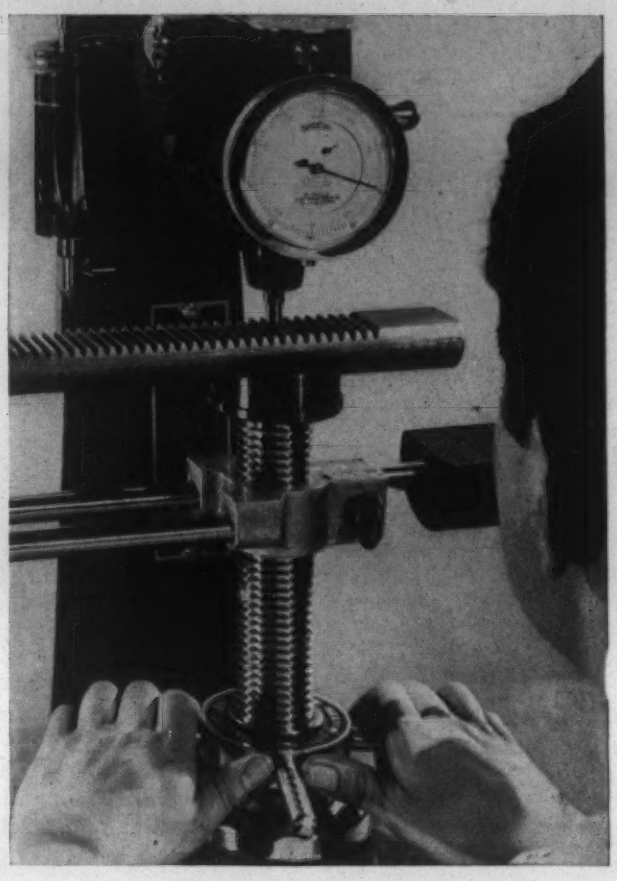

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The Notch-toughness of Cast Steel (Ueber die Kerbzähigkeit von Stahlguss) E. KNIPP & W. KERL. *Giesserei.* Vol. 23, Nov. 6, 1936, pages 594-596. The great value of notch-impact testing for cast steel is emphasized and test curves are given to show the relation between notch-toughness and tensile strength, yield point and elongation for a basic electrically melted cast steel. Ha (9b)

Comparison of Bending around a Mandrel and Free Bending (Vergleichende Faltversuche mit Dornbeigung und Freibeigung) R. MAILANDER & W. RUTTMANN. *Technische Mitteilungen Krupp,* Vol. 4, Nov. 1936, pages 155-162. Experiments with non-welded samples to decide whether bending tests are improved by bending or folding the sample around a mandrel or bending it freely through an angle of given magnitude, are described. It was found that for similar samples, the bending angles in both cases were about the same for fracture, but that a slight pressure effect exerted by the mandrel reduced the deformability of the sample. 12 references. Ha (9b)

The Interpretation of Creep Tests for Machine Design. C. R. SODERBERG. *Transactions of the American Society of Mechanical Engineers,* Vol. 58, Nov. 1936, pages 733-743. Practical application of creep-test data to problems of machine design is explained on the basis of plastic flow in polycrystalline materials, for which a theory is derived. Ha (9b)

Photocells in the Rolling Mill (Photozellen im Walzwerk) K. JOHANNSEN. *Elektrotechnische Zeitschrift,* Vol. 57, Feb. 6, 1936, pages 150-152. Principles and applications of the photocell to operation control and testing are described. Ha (9b)

Stress Concentration. MAX M. FROCHT. *Mechanical World & Engineering Record,* Vol. 100, Sept. 25, 1936, pages 293-296. An extended abstract of a paper before the A.S.M.E. dealing with a photo-elastic study of test pieces having stress raising features of the kinds commonly encountered in practice. 13 illustrations. WH (9b)

9c. Fatigue Testing

H. F. MOORE, SECTION EDITOR

The abstracts appearing under this heading are prepared in co-operation with the A.S.T.M. Research Committee on Fatigue of Metals. The purpose of this cooperation is to make readily available complete references to the literature on this subject. The Committee does not necessarily subscribe to the statements of either the author or the abstractor.

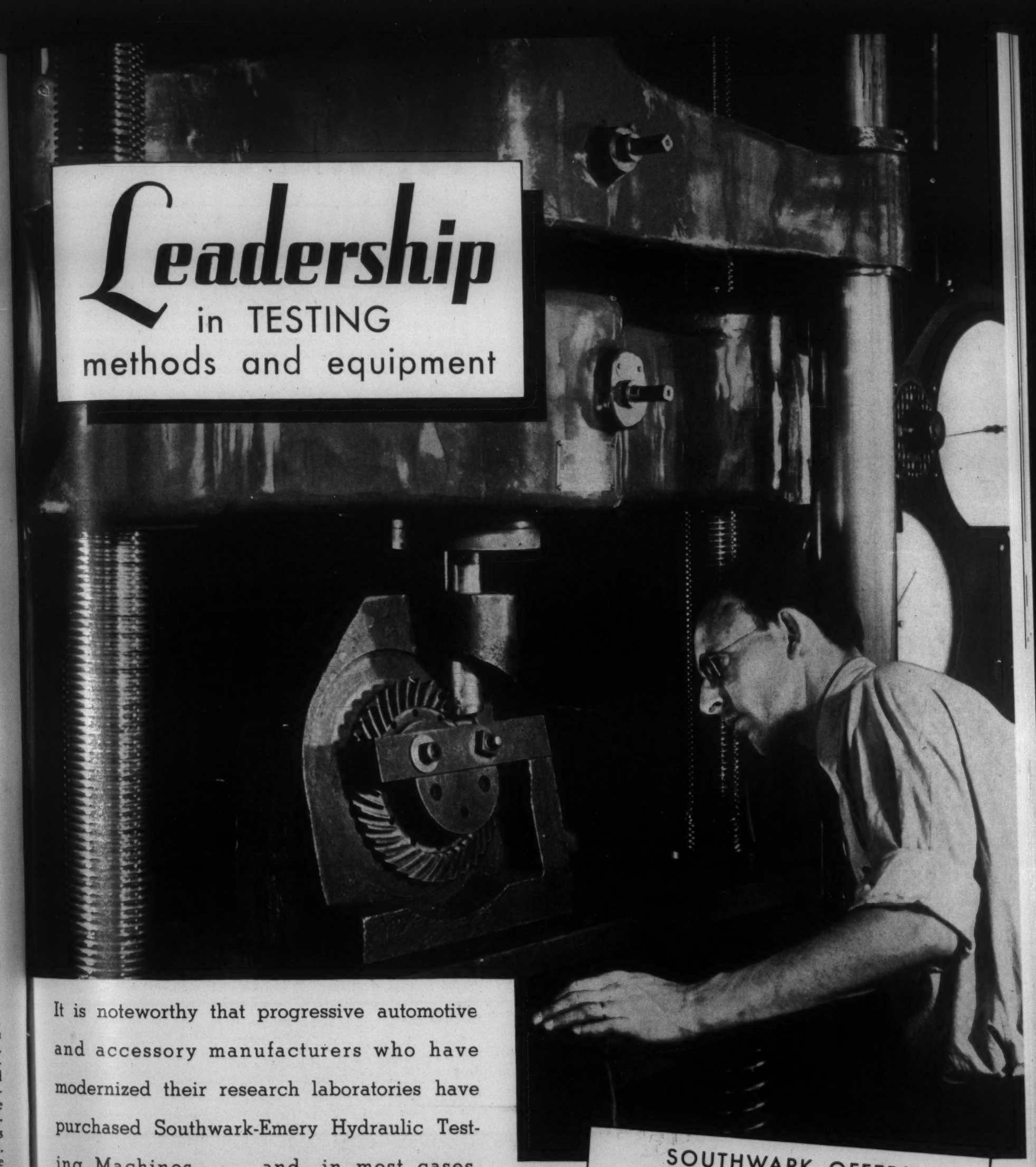
Endurance Tests on Electrolytic Tough Pitch and Oxygen-Free Copper Wire. J. N. KENYON. *Wire & Wire Products,* Vol. 11, Oct. 1936, pages 576, 593. Tests with hard drawn Cu wires show that, in general, O-free materials possess a somewhat higher endurance limit, and that the effect of the usual commercial surface condition on endurance limit of Cu wire is not so pronounced as in the case of steel wire. A new fatigue testing machine is described. Ha (9c)

How and When Does a Fatigue Crack Start? H. F. MOORE. *Metals and Alloys,* Vol. 7, Nov. 1936, pages 297-299. Discussion of the mechanism of the formation of cracks by repeated loading. Oil-whitewash magnetized iron dust and etching methods of detecting fatigue cracks on the surface of metal parts are described and briefly discussed. The method of determining the probable damage line for a material is described. This method will show the effect of overstress for a limited number of cycles upon the endurance of the material. It is claimed that cracks in single crystals of Pb may be detected in X-ray diffraction films of the crystal. X-ray diffraction studies offer a promising field for research in the detection of fatigue cracks in their early stages. WLC (9c)

9e. Spectrography

L. W. STROCK, SECTION EDITOR

Experiments on Spectrographic Analysis (Versuche zur chemischen Spektralanalyse) W. GERLACH & W. ROLLWAGEN. *Metallwirtschaft,* Sept. 4, 1936, pages 837-840. Illustrations show the greater sensitivity of an interrupted arc as compared to a spark spectrum, and demonstrate that banding can be suppressed by high currents and short arcs. GD (9e)



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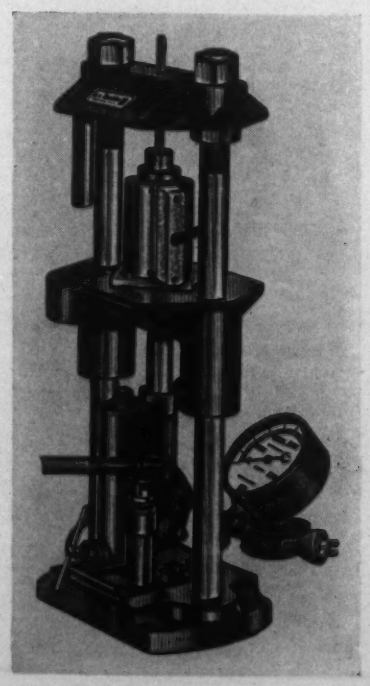

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10. METALLOGRAPHY

J. S. MARSH, SECTION EDITOR

Metal Research with Supersonic Waves (Metallforschung mit Ultraschall) H. J. SEEMANN. *Metallwirtschaft,* Vol. 15, Nov. 6, 1936, pages 1067-1069. A short review is presented of the metallurgical application of supersonic waves of scientific and practical interest. Some of the possibilities of supersonic waves in the liquid-metal field are the production of mercury oil emulsions, the formation of intimate mixtures of metals immiscible in the liquid state, the degasing of molten metals, and the removal or dispersion of non-metallic inclusions. Phenomena occurring during freezing and in the solid state are noted. GA (10)

The α-β Transition with Mechanically Treated and with Untreated Zirconium. I. H. DE BOER, P. CLAUSING & I. D. FAST. *Recueil des Travaux Chimiques des Pays-Bas,* Vol. 55, June 15, 1936, pages 450-458. In English. In 1926 a change in modification of Zr at higher temperatures was discovered by Zwikker *(Physica,* Vol. 6, 1926, page 361). He found no sharp transition temperature, but a transition range of about 300° C. Later determinations with undeformed Zr rods by other methods yielded a sharp transition temperature. It has now been shown by means of resistance measurements on Zr rods which had previously undergone various treatments, that the indefinite character of the $\alpha \rightarrow \beta$ transition in resistance measurements of Zr wires may be ascribed not to the deformation itself, but to the heating in air at different stages during the deformation. The $\alpha \rightarrow \beta$ transition temperature was found to be 865° ± 10° C. which agrees well with a value determined by Vogel & Tonn by another method. The total radiation of β-Zr is proportional to $T^{4.7}$. EF (10)

The Influence of Oxygen and Nitrogen on the $\alpha \rightarrow \beta$ Transition of Zirconium. I. H. DE BOER & I. D. FAST. *Recueil des Travaux Chimiques des Pays-Bas,* Vol. 55, June 15, 1936, pages 459-467. In English. Summary in German. Zr can dissolve O and N up to more than 10 at. %. In this case the hexagonal (α) Zr does not change to the regular (β) Zr at a definite temperature but in a temperature range of 910-1550° C. at 10 at. % O. In this temperature range a low-O β-phase is apparently in equilibrium with an α-phase rich in O. The electrical resistance of a certain test rod is well defined by temperature. The resistance curve shows no hysteresis effects. If O and N are dissolved in Zr, hysteresis effects occur on the resistance temperature curves. The character of the resistance curves is influenced but little, if at all, by the addition of Al. EF (10)

The α-β Transition in Zirconium in the Presence of Hydrogen. I. H. DE BOER & I. D. FAST. *Recueil des Travaux Chimiques des Pay-Bas.* Vol. 55, May 15, 1936, pages 350-356. In English. H may be dissolved in α- as well as in β-Zr. In both modifications the solubility decreases with rising temperatures. If α-Zr changes to β-Zr with rising temperature in the presence of H, H is taken up, while during cooling β-Zr changes over into α-Zr and gives off H. Attention is called to a very rapid evolution of H during cooling of Zr wire as discovered by Clausing & Ludwig. The $\beta \rightarrow \alpha$ transition of Zr seems to be a prerequisite for this phenomenon. EF (10)

Inverse Segregation and Gas Solubility in Tin Bronzes (Umgekehrte Blockseigerung und Gaslöslichkeit, studiert an Zinn-Bronzen) W. CLAUS & R. W. BAUER. *Metallwirtschaft,* Vol. 15, June 26, 1936, pages 578-600. The amount of inverse segregation is measured by the difference in Sn content between the surface and the core of the bronze casting. Samples melted under the neutral gases CO + CO_2, and N_2 were considered normal. Melting under H_2, which is soluble in the melt but evolved during solidification, gave extreme inverse segregation, and H_2S which reacts to give Cu_2S + H_2 has the same effect, while SO_2 which forms Cu_2S + SnO_2 had no influence. Additions of P and Li, which tend to reduce the amount of dissolved, uncombined H_2, decreased the amount of segregation, while Zn and Al had little influence. High density of the material was accompanied by little segregation and vice versa. Slow freezing gives rise to intercrystalline segregation and eliminates the inverse type which occurs with medium rates of freezing. These rates favor the formation of a residual melt and high internal gas pressure, the latter being considered the primary cause of inverse segregation. GD (10)

Transformation Twinning of Alpha Iron. ALDEN B. GRENINGER. *Transactions American Institute of Mining & Metallurgical Engineers,* Vol. 120, *Iron & Steel Division,* 1936, pages 293-308. Includes discussion. See *Metals and Alloys,* Vol. 7, July 1936, page MA 363R/3. (10)

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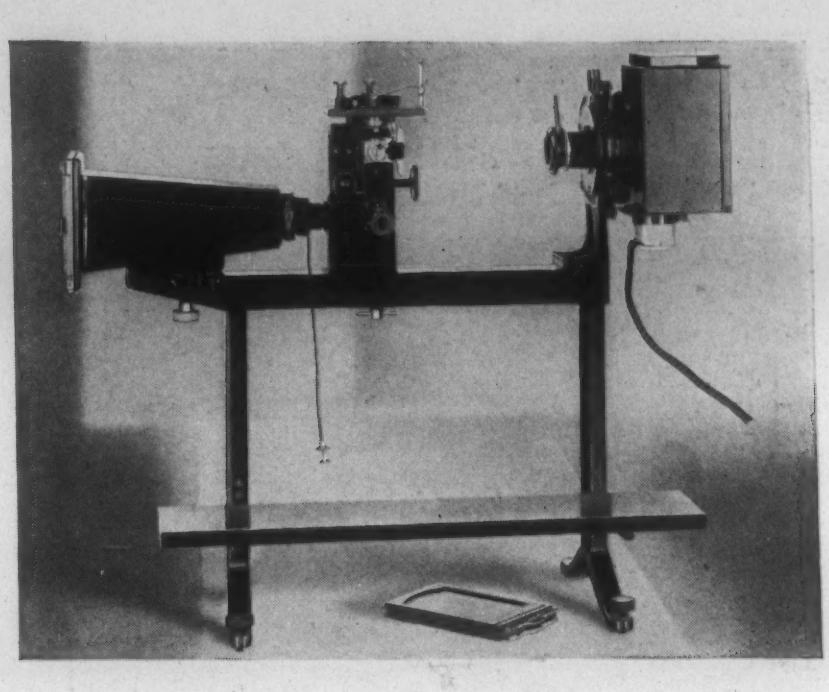

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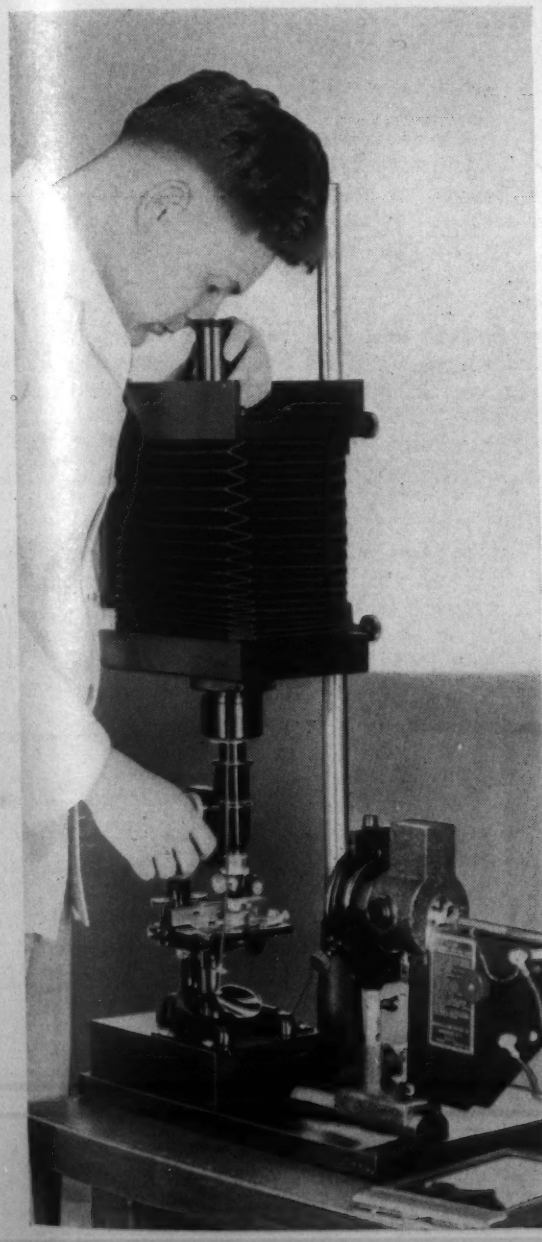

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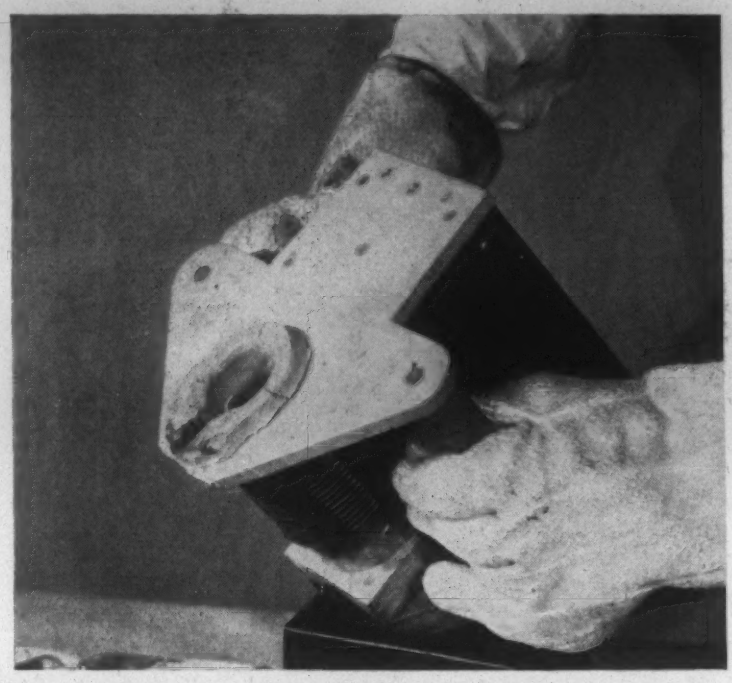

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Preparation of Etched Sections for Microscopic Examination of Aluminum and Its Alloys (Ueber die Anfertigung von Schliffproben zur mikroskopischen Untersuchung von Aluminium und dessen Legierungen) E. KÄPERNICK. *Aluminium,* Vol. 18, Sept. 1936, pages 433-435. Suggestions and directions are offered, giving precautions to be observed because of the softness of Al. Ha (10)

Nickel-Zinc System (Zu dem System Nickel-Zink) W. KEIKE, J. SCHRAMM & O. VAUPEL. *Metallwirtschaft,* Vol. 15, July 10, 1936, pages 655-662. The Ni-Zn system was restudied with a view toward settling existing discrepancies in the literature. Purer materials were used with a more sensitive means of thermal analysis, coupled with microscopic and X-ray examination. The earlier equilibrium diagram of the authors is essentially substantiated. The peritectic α + melt $\rightarrow \beta'$ is placed at 49.5 weight % Ni which leads to the interpretation of β' as a body-centered cubic solid solution rather than as a modification of the tetragonal compound NiZn. GD (10)

Structure of Plastically Deformed Crystals According to Laue Patterns. II. A. KOMAR & M. MOCHALOV. *Physikalische Zeitschrift der Sowjet-Union,* Vol. 9, No. 6, 1936, pages 613-617. In English. Reports on qualitative studies on the angular and spatial distribution of the rotated parts in a single crystal of Mg, plastically deformed 10%. The existence of an angular width in the reflections of Mo-Kα-radiation from the 0001 plane of a Mg single crystal and the existence of "tails" in the Laue diagrams of the same crystals are due to a regular inhomogeneity in the spatial distribution of the rotated parts. This can be interpreted as a mosaic curvature of the gliding plates around a direction perpendicular to the direction of gliding. WH (10)

Structure of Plastically Deformed Crystals According to Laue Patterns. I. A. P. KOMAR. *Physikalische Zeitschrift der Sowjet-Union,* Vol. 9, No. 5, 1936, pages 413-432. In English. Reviews briefly the various conceptions advanced on the structure of plastically deformed crystals as based upon experimental data obtained by the Laue method. A graphical-analytical method for evaluating Laue patterns of plastically bent crystals is proposed. The experimental results are found to be in agreement with the calculated ones. WH (10)

The Solid Solubilities of the Elements of the Periodic Subgroup Vb in Copper. J. C. MERTZ & C. H. MATHEWSON. *Metals Technology,* Sept. 1936, *American Institute Mining & Metallurgical Engineers Technical Publication* No. 747, 20 pages. Solid solubilities of P in Cu, As in Cu, and Sb in Cu were determined by the X-ray back-reflection method. The solubility of P is about 1.7% at 700° C. and decreases to about 0.6% at 300° C. For As the solubility is about 8% at 680° C. and decreases slowly to about 7.5% at 300° C. For Sb the solubility of β in α falls slowly from about 11.3% at 630° C. to about 10% in the neighborhood of 450° C., the solubility of γ falls rapidly from this point to about 2.1% at 211° C. Experimental evidence indicates that the effect of quenching strains on lattice-parameter values is practically, if not entirely negligible in these alloys. The application of the law of dilute solutions generalizes the solubility data and therefore indicates that the experimental observations define a true state of equilibrium. Work by other investigators has shown that Bi is only slightly soluble in solid Cu. 24 references. JLG (10)

Preferred Orientation and Rolling Characteristics of Low Carbon Strip Steels. CARL B. POST. *Transactions American Society for Metals,* Vol. 24, Sept. 1936, pages 679-700. The preferred orientation existing in cold-rolled strip steel shows that "mean" orientation is specified by a [110] direction of the unit cell along the direction of rolling with a cube face tending to become parallel to the plane of rolling at high % reduction. Diameter of working roll influences the angle of deviation of [110] direction from the rolling axis, small rolls producing greater deviation. Roll size has no effect upon deviation of cube face from the plane of rolling. 7 references. WLC (10)

Deformation and Lattice^s Constants (Verformung und Gitterkonstante) A. PHILLIPS & R. BRICK. *Metallwirtschaft,* Vol. 15, June 12, 1936, pages 541-542. Previous work is reviewed which indicates that the lattice constants of quenched solid solutions become greater with the cross section of the material. New results for an alloy of Au with 25 atomic % Ag are reported. In a series with decreasing cross section and increasing amount of cold drawing before annealing the lattice constant, A_o, shows maxima at 2 and 74% reductions, while with constant cross section maxima occur at 48 and 90% reductions. These remain unexplained. See *Metals and Alloys,* Vol. 5, Dec. 1934, page MA 581L/5. GD (10)

Manganese-Carbon System and the Carburization of Manganese Alloys (Untersuchungen über das System Mangan-Kohlenstoff und die Kohlung von Mangan-Legierungen) R. SCHENCK, N. G. SCHMAHL & O. RUETZ. *Zeitschrift für Elektrochemie,* Vol. 42, July 1936, page 569. Pure Mn was carburized with CH_4 at 700°, 800° and 900° C. It was found that Mn_3C at 800° and 900° C. dissolves 0.5% C. Higher carbides were not found. Mn-Fe alloys (50% Mn and 50% Fe) were carburized at 800° and 900° C. In this alloy Mn_3C stabilizes an equivalent amount of Fe_3C. At 900° C. this alloy exhibits a high solubility for C. In Mn-Cu alloys carburization is completely suppressed. It is pointed out that the addition of a more noble metal (noble with respect to C solubility) to a less noble metal raises the nobility of the latter, e.g., addition of Cu to Mn. Moreover, a nobler metal may be rendered less noble by additions of a less noble metal, e.g., additions of Mn to Fe. HAS (10)

X-Ray Study of the Ternary System Ni-Cu-Zn (Röntgenographische Untersuchungen an dem Dreistoffsystem Ni-Cu-Zn) J. SCHRAMM & O. VAUPEL. *Metallwirtschaft,* Vol. 15, July 31, 1936, pages 723-726. Composition limits of various phases of Ni-Cu-Zn system which are stable at room temperature were determined by X-ray powder photograms of slowly cooled alloys. The ternary diagram published must be consulted for specific data. GD (10)

Application of the Quantum Theory of Metals to the Phase Equilibrium in Alloys (Die Anwendung der Quantentheorie der Metalle auf das Phasengleichgewicht in Legierungen) S. T. KONOBEJEWSKI. *Annalen der Physik,* Series 5, Vol. 26, May 1936, pages 97-115. According to present status of knowledge of the structure and phases of alloys it seems to be more correct to treat the stability of phases of the Hume-Rothery type not as chemical compounds with definite chemical formula but as the true intermetallic phases of varying composition the stability of which is determined principally by the property of the electron gas of given concentration to produce a minimum of energy at a definite lattice structure. In determining the conditions for the heterogeneous equilibrium of 2 solid solutions it is found that the theory of Bloch-Brillouin permits calculating the minimum energy on the curve of the total energy or of the thermodynamic potential respectively. 13 references. Ha (10)

11. PROPERTIES OF METALS AND ALLOYS

Chemical Heterogeneity of Solid Solution in Cast Alloys (Hétérogénéité Chimique des Solutions Solides dans les Alliages Moulés) PIERRE CHEVENARD. *Bulletin de l'Association Technique de Fonderie,* Vol. 10, May 1936, pages 152-165. Paper presented at the Feb. 18, 1936 meeting of the A. T. F. Solid solutions are nearly all heterogeneous. The thermomagnetic method gives the best quantitative values for the heterogeneity of solid solutions. In certain alloys subject to hardening the condition of homogeneity which precedes the separation into two phases is a factor in the hardness as well as the fatigue resistance of the metal. The heterogeneity of the solid solution is the essential factor in intercrystalline corrosion. 6 references. WHS (11)

11a. Non-Ferrous

A. J. PHILLIPS, SECTION EDITOR

Research in Tungum Alloy. B. C. LAWS. *Shipbuilder and Marine Engine-Builder,* Vol. 43, Oct. 1936, page 527. Brief reply to correspondence concerning a previous article by the author. See *Metals and Alloys,* Vol. 8, Feb. 1937, page MA 103 R/6. JWD (11a)

Indium—A Metal Aristocrat. SIDNEY J. FRENCH. *Scientific American,* Vol. 156, Jan. 1937, pages 20-21. Properties of In and uses in low melting alloys are discussed. CBJ (11a)

Vapor Pressures of Barium (Die Dampfdrücke des Bariums) I. A. M. VAN LIEMPT. *Recueil des Travaux Chimiques des Pays-Bas,* Vol. 55, June 15, 1936, pages 468-470. In German. The following vapor pressure formula is derived:

$$\log p \text{ (mm.)} = \frac{-9727}{T} + 7.83$$

The boiling point of Ba is 1696° C., the Trouton constant = 22.6 and the evaporation heat = 44450 cal./g. atom. An equation for the evaporation speed in a vacuum is given. EF (11a)

Diffusion Constant and Valency of Silver in Silver Amalgam (Die Diffusionskonstante und Wertigkeit des Silbers in flüssigem Silberamalgam) KARL SCHWARZ & RÜDIGER STOCKERT. *Sitzungsberichte der Akademie der Wissenschaften in Wien, Mathematisch-naturwissenschaftliche Klasse, Sektion IIb, Chemie,* Vol. 145, No. 6, 1936, pages 603-606. The diffusion constant of Ag in Ag-Hg at 16° C. was found to be

$$1.1_1 \times 10^{-5} \text{ cm.}^2\text{/sec.}$$

The bi-valency of Ag in Ag-Hg has thus been corroborated. WH (11a)

11b. Ferrous

V. V. KENDALL, SECTION EDITOR

On the Effect of Phosphorus on the Properties of Basic Carbon Steel (Ueber die Wirkung des Phosphors auf die Eigenschaften von basischem unlegiertem Stahl) A. RISTOW & K. DAEVES. *Stahl und Eisen,* Vol. 56, Aug. 6, 1936, pages 889-899; Aug. 13, pages 921-930. The effort to obtain a low P content in basic Bessemer steel tends to raise the O_2 content of the slag and metal and lower the Mn economy. Medium P contents do not injure the technologic properties or serviceability of structural or rail steel. To a certain extent the wear resistance, weldability, machinability, and corrosion resistance are benefited by higher P. Low P steel may be higher in oxide inclusions, may have poor weldability, may cause sticking in sheets, and may give poor wear in rails. SE (11b)

A Simple Apparatus for the Measurement of Thermal Expansion. J. W. BAMPFYLDE. *Bulletin of the British Cast Iron Research Association,* No. 4, No. 10, Report No. 154, Oct. 1936, pages 389-390. Describes the apparatus plus sketch and photo. Curve indicates excellent results are obtained in determining critical temperatures on heating and cooling. WB (11b)

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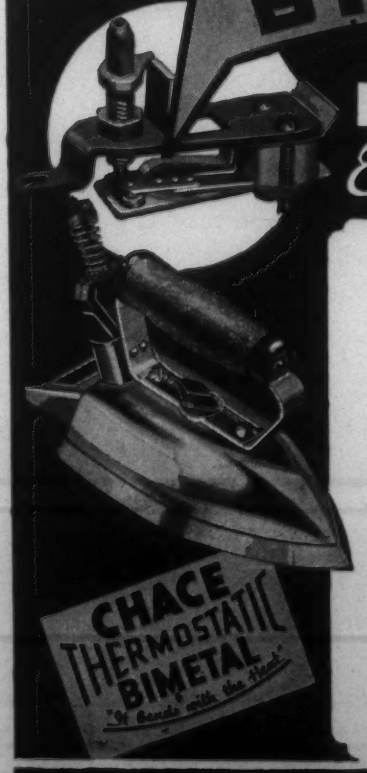

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Tantalum-Iron Alloys and Tantalum Steels. R. GENDERS & R. HARRISON. *Iron & Coal Trades Review,* Vol. 133, Oct. 9, 1936, page 607. Ta-Fe alloys with up to 61% Ta can be considered as an alloy system of Fe and the compound Fe_2Ta. A eutectic of the solid solutions δ and ϵ (Fe_2Ta) is formed at 20%Ta. At 61.2% Ta the alloy consists entirely of Fe_2Ta and at higher Ta contents a second eutectic is formed of about 80% Ta. Addition of Ta to Fe raises hardness progressively, but at a lower rate between 7 and 30% Ta than in the lower and higher ranges of Ta addition. With increasing Ta content in C steels the proportion of C in the form of Fe_3C decreases, and above a certain Ta concentration, depending on C content, the steels become essentially Ta-Fe alloys containing inclusions of an additional hard carbide constituent, apparently insoluble. These steels are difficult to work. At temperatures above 1000° C., oxidation of Ta steels is very rapid, producing a thick, adherent scale. No marked corrosion-resistance was noticed in plain Ta steels. Addition of Ta to low Mn-Ni steels shows no real improvement. Ta does not confer air-hardening properties and reduces the maximum hardness attainable by quenching, but reduces the fall of hardness on tempering; it also induces susceptibility to temper-brittleness in Ni steel to an appreciable extent. Although addition of Ta increases depth of penetration of nitriding, an extremely high hardness is not attained. Alloys with some Al together with Ta or Cb show increased hardness, however, up to 1000 Vickers diamond hardness with no appreciable decrease in depth of penetration. A method of chemical estimation of Ta in Fe alloys is added. Ha (11b)

Making and Treating "Chromal" (Megapyr), an Alloy Having a High Ohmic and Heat Resistance. A. A. BABAKOV & V. S. RUTES. *Kachestvennaia Stal,* Vol. 4, No. 3, 1936, pages 13-21. In Russian. These alloys containing 0.4 C, 0.4 Mn, 30 Cr and 5% Al were prepared in a 100 kg. high frequency furnace by lining the crucible with low C scrap steel surrounding the core of Fe-Cr. Teeming temperature must be below 1520° C. to prevent coarse crystallization which interferes with forging. Hot ingots directly from molds should be placed in a furnace at 1150° C. and soaked there for the length of time corresponding to their section. They are forged at 1150°-900° C. using gradually increasing strength of blows. When cold metal is used it should be furnace heated for 1 hr./cm. of thickness. Rolling is done in the interval 1150°-800° C. with pass design similar to that used with 18-8 Cr-Ni steel. Before cold drawing the stock is heated at 740°-780° C. for 40-50 minutes and quenched in water. Cold working can be continued to about 70%, after which softening treatment is required, but in wire drawing 50% is the limit. Optimum softening of cold reduced material is obtained on heating at 750°-800° C. The alloy does not have any critical points. (11b)

Internal Transformations and Mechanical Properties of Cromansil Steel. M. M. KANTOR & F. M. ZAIDEL. *Kachestvennaia Stal,* Vol. 4, No. 6, 1936, pages 31-34. In Russian. Sheets 2 mm. thick and containing 0.32% C, 1.12 Mn, 1.30 Si, 1.08 Cr were investigated dilatometrically and by determination of mechanical properties. S-curve was determined using isothermic decomposition. The results were compared with properties produced by quenching and drawing. Isothermic decomposition yielded greater elongation and toughness with the same strength. (11b)

Cast Iron and the Engineer. A. L. MELLANBY. *Foundry Trade Journal,* Vol. 54, June 25, 1936, pages 497-501. Paper chiefly concerned with difficulties met in the manufacture of large marine Diesel engines. According to the data available the maximum observed temperature of the piston (air cooled) is 480° C. but under normal working conditions it is only 340° C. The experiments were carried out upon an Fe of approximately the following composition: T. C., 3%; C.C., 0.6% to 0.7%; Si, 1.5%; Mn, 1% to 1.5%; S, 0.08% max.; P, 0.50% max. It was found that the tensile strength diminished as the temperature rose, until at some point between 390° and 480° F. it had its minimum value. With further increaese of temperature the tensile strength rose until at about 750° C. its value was higher than that at atmosphere temperature. It was also found that a soaking of the material at a temperature associated with the maximum strength (750° F.) increased the strength at all useful temperatures; in addition, the minimum strength characteristic at 450° F. has entirely disappeared. The curves showing influence of a prolonged heating on strength of loaded cast Fe bars (aging effect) resembled those commonly presented for steel tested for the determination of the "creep" stress limit. Wear and growth tests are also discussed. AIK (11b)

Development of the Cast Iron Enamel Industry (Die Entwicklung der Gussemailindustrie) *Emailwaren-Industrie,* Vol. 13, Sept. 17, 1936, pages 310-315. Includes a brief discussion on the physical properties of cast irons used. RAW (11b)

The Elastic Properties of High Grade Steels (Contributo allo studio delle proprieta elastiche degli acciai ad alta resistenza) RAFFAELE ZOJA. *Atti della Reale Accademia delle Scienze di Torino,* Vol. 71, May-Oct. 1936, pages 580-587. The elastic properties of a Cr-Ni-Mo steel (analysis C 0.28%, Si 0.25, Mn 0.66, Cr 0.70, Ni 2.98, Mo 0.57, S 0.01, P 0.15) are changed appreciably by permanent deformations of the order of 0.2%. The samples were hardened at 800-825° C., then tempered at 600-625° C. Under permanent deformation, the hysteresis cycle is increased, but this change is unstable and disappears on aging the sample by holding it for 6 hrs. in an oil bath at 220-230° C. AWC (11b)

12. EFFECT OF TEMPERATURE ON METALS AND ALLOYS

H. C. CROSS, SECTION EDITOR

The abstracts in this section are prepared in co-operation with the Joint High Temperature Committee of the A.S.M.E. and the A.S.T.M. The purpose of this cooperation is to make readily available complete references to the literature of this subject. The Committee does not necessarily subscribe to the statements of either the author or the abstractor.

The Creep Curve and Stability of Steels at Constant Stress and Temperature. S. H. WEAVER. *Transactions of the American Society of Mechanical Engineers,* Vol. 58, Nov. 1936, pages 745-751. The creep rate for steels at constant stress and elevated temperature is determined by (1) strain hardening, at a rate which varies inversely with time, and (2) an asymptotic constant creep rate. The sum of both gives the creep rate at any time for which the formula $e = v_a t + a \log t - b$, and $b = a \log t_o$ was derived, where e is the total creep elongation, (in. per in. of length), v_a is the constant creep rate, 10^{-7} in. per in. per hr. (10^{-7} equals 1% creep in 100,000 hr.), a the strain hardening constant, t the time in hr., t_o the test constant indicating stability of metal structure and at the same time representing a "time modulus" for the rate of strain hardening; b is a test constant for a particular test and material and is considered to be zero for stable metals. The accuracy of the formula was checked by long-time tests extending from 5000 hr. to 5 years. Examples are described which show the affect of differences in structure. Ha (12)

The Influence of High Temperatures on Stud Boiler Steel. DOUGLAS WILSON. *Steam Engineer,* Vol. 5, July 1936, pages 430-431; Aug. 1936, pages 477-488. A review. AHE (12)

The Scaling of Steels in Sulphur-free and Sulphur-containing Furnace Atmospheres. A. PREECE, G. T. RICHARDSON & J. W. COBB. *Iron & Coal Trades Review,* Vol. 133, Nov. 20, 1936, page 888. Special Report No. 14 of the Alloy Steels Research Committee, *Iron & Steel Inst.,* summarizes the results of recent investigations. In atmospheres consisting of 80% N_2, 10% CO_2, 10% H_2O at 1000° C. the rate of scaling of plain C steels decreased progressively with increasing C content of the metal, but when SO_2 was added to the atmosphere scaling increased rapidly irrespective of the C content of the metal. Resistance to scaling from 4% Si addition was rapidly destroyed when SO_2 was admitted to the atmosphere; the same was found for a 12% Cr and a 5% Ni steel, but with an 18% Cr-8% Ni steel the scaling resistance was not affected by presence of SO_2. Ha (12)

Influence of Silicon and Aluminum on the Resistance of Cast Iron to High Temperature (Influence du Silicium et de l'Aluminium sur la Résistance à Température Elevée des Fontes) H. THYSSEN. *La Fonderie Belge,* Vol. 4, May-June 1935, pages 256-272; July-Aug.-Sept. 1935, pages 283-306. See *Metals and Alloys,* Vol. 5, Dec. 1934, page MA 584. FR (12)

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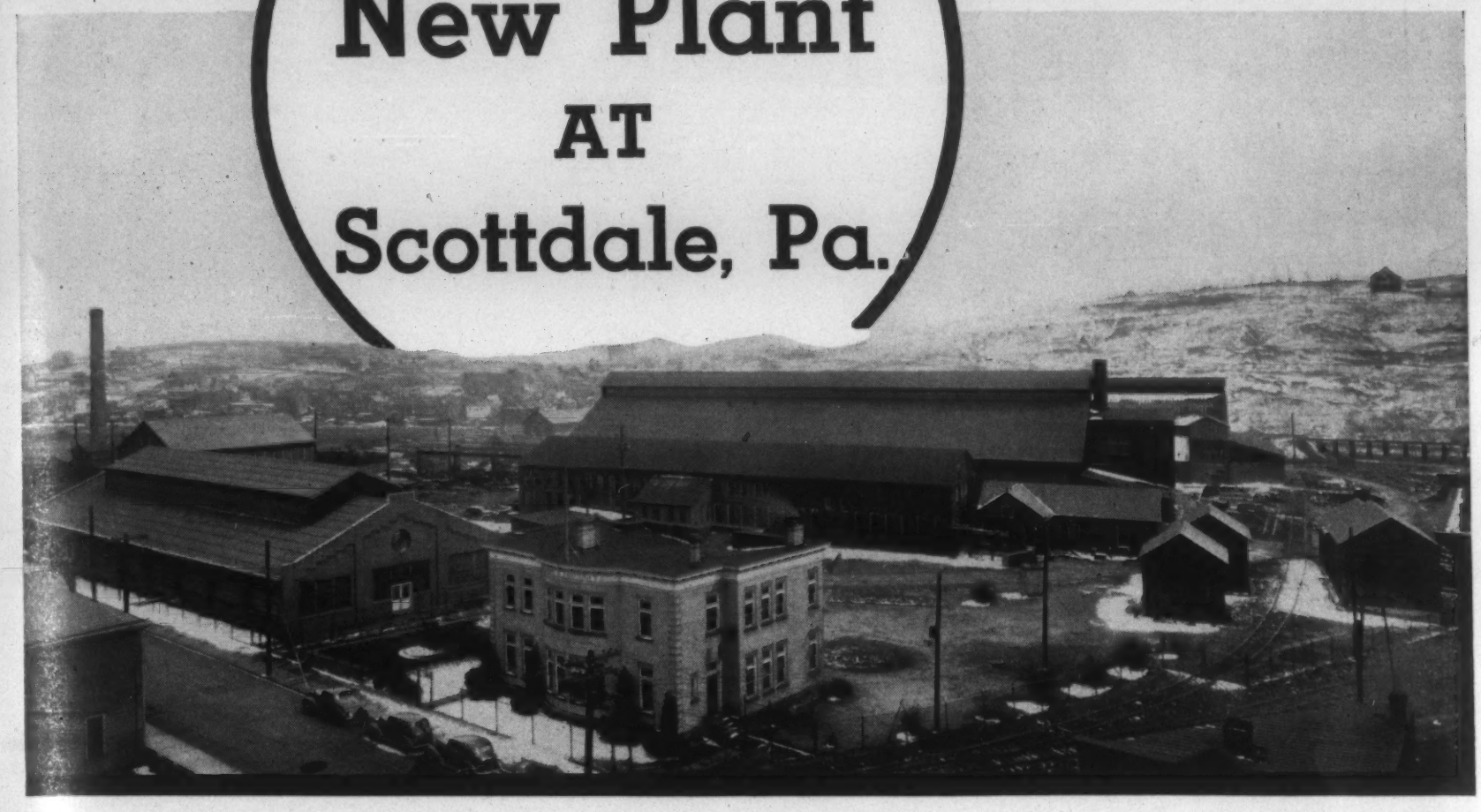

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13. CORROSION AND WEAR

V. V. KENDALL, SECTION EDITOR

Polished, Glossy, Impure Tin Foil, Free from External Contaminations, Becomes Effervescent in Dilute Hydrochloric and Sulphuric Acid. Thick Samples Remain Quiescent (Sous forme "papier," l'étain impur, lisse, brilliant et sans souillures extrinsèques, fait evervescence dans HCL ou H_2SO_4 étendus. Épais, il reste silencieux) PAUL RONCERAY. *Bulletin de la Société Chimique de France,* Series 5, Vol. 3, July 1936, pages 1290-1294. The type of corrosion attack of HCl and H_2SO_4 (10%) at 20° and 90° C. on Sn foil, Sn sheet and tinned Fe was investigated. As was previously established with Al, Zn and Fe the same kind of reaction takes place in the presence of O with thicker sections of Sn sheet and with tinned Fe:

$$2\ HCl + Sn + O \rightarrow SnCl_2 + H_2O.$$

The effervescent effect on Sn foil is attributed to local element effects of impurities which become quickly exposed. With increasing sheet thickness, effervescence decreased and was absent on tinned Fe and heavier sheets. At 90° C. effervescence could be brought about on thick Sn sheet in HCl by contacting with Sn, Pb or Cu powder. No effervescence took place in H_2SO_4. EF (13)

Lead, Impure but without External Contamination, Exhibits no Effervescence in Dilute Hydrochloric or Sulphuric Acid (Le plomb impur exempt de souillures extrinsèques ne fait pas effervescence avec HCl ou H_2SO_4 étendu) PAUL RONCERAY. *Bulletin de la Société Chimique de France,* Series 5, Vol. 3, July 1936, pages 1294-1297. Dilute H_2SO_4 and HCl attack Pb without gas liberation, the latter being more effective than the former. The presence of O is indispensable for this type of corrosion also observed with Sn, Al, Zn and Fe:

$$Pb + 2\ HCl + O \rightarrow PbCl_2 + H_2O.$$

Addition of 0.1% HCl accelerates the corrosion attack of H_2SO_4. Cu particles pressed into Pb caused gas evolution at elevated temperatures but not at ordinary temperatures. Superficial contact between Pb or Cu particles and Pb did not lead to effervescence. EF (13)

Partially Tinned and Polished Iron Does not Effervesce in Dilute Acids (Le fer étainé et poli, ne fait pas effervescence dans les acides étendus) PAUL RONCERAY. *Bulletin de la Société Chimique de France,* Series 5, Vol. 3, July 1936, pages 1297-1301. The quiescent reaction of the Sn counteracts the effervescence of the Fe and promotes a quiescent corrosion of Fe, too. When effervescence of the Sn does occur, the quiescent corrosion of Fe is inhibited, and effervescence is favored. Ronceray assumes an "antagonism" between different types of corrosion when different metals are in contact whereas an "alliance" takes place between similar ones. Sn, which is, in this case, considered to be a major constitutional impurity, fails to further the effervescence of Fe. This behavior falls in line with the effect of impurities on the effervescence of Sn, Al, Fe, and Zn. EF (13)

Antagonisms and Alliances Between the Effervescent and Silent Types of Corrosion of Aluminum, Zinc, Iron, Tin, and Lead in Dilute Acids are of Electric Nature (Antagonismes et alliances expérimentalement démontrés entre corrosions effervescentes et silencieuses de Al, Zn, Fe, Sn, Pb dans les acides étendus, sont de nature électrique) PAUL RONCERAY. *Bulletin de la Société Chimique de France,* Series 5, Vol. 3, July 1936, pages 1301-1303. Based on previous research and on new corrosion tests with tinned Fe exposed to 2% HCl the theory is introduced that the electric current leading to the silent types of corrosion goes in the opposite direction to that responsible for the effervescence phenomenon. Due to certain factors the currents can be reversed resulting in a change of the type of corrosion. EF (13)

Corrosion of Steel Cars by Coal. G. N. SCHRAMM, E. S. TAYLERSON & C. P. LARRABEE. *Railway Age,* Vol. 101, Nov. 28, 1936, pages 780-785. 80% of corrosion of steel cars is due to atmospheric corrosion. Open top cars in average service are not subject to appreciable corrosion by $Fe_2(SO_4)_3$ leachings from coal. The leachings from wet coal of moderately high S content do not become severely destructive until the coal has been stored from 4-6 weeks. Test methods do not duplicate average service conditions and may be misleading or misinterpreted. Oxide films which form on steel are protective to the atmosphere, under wet coal, and in $Fe_2(SO_4)_3$ leachings. CBJ (13)

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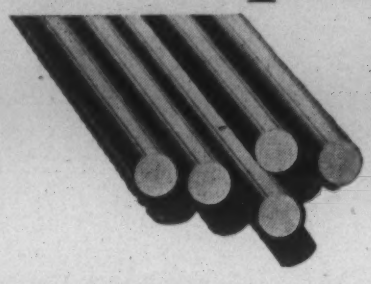

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Theory is in Agreement with Experimental Results on the Effect of Intrinsic and Extrinsic Impurities of Metals Immersed in Dilute Acids (La théorie est d'accord avec nos résultats expérimentaux concernant les impuretés intrinsèques et extrinsèques des métaux immergés dans les acides étendus) PAUL RONCERAY. *Bulletin de la Société Chimique de France,* Series 5, Vol. 3, July 1936, pages 1303-1306. From previous experimental evidence the following conclusions are drawn: (1) Theoretically, the structural impurities in polished and sufficiently thick metal samples cannot set up local electrical currents, because under these conditions the contact angle between matrix and embedded impurity approaches 180°. This means a long and rather resistant path for the exchange of ions. A scheme is presented showing the local electric current conditions prevailing with extrinsic and larger intrinsic impurities. Owing to gradual elevation of foreign matter above the surface an intensification of local elements takes place assuming the character of a conflagration. EF (13)

By the Interactions of Their Antagonisms and Alliances, Corrosion Reactions Tend Toward a Maximum or a Minimum (Par le jeu de leurs antagonismes et alliances, les réactions de corrosions tendent vers un maximum ou un minimum) PAUL RONCERAY. *Bulletin de la Société Chimique de France,* Series 5, Vol. 3, July 1936, pages 1306-1309. A scheme is suggested showing the relations between the factors promoting effervescence on one hand and causing the silent type of corrosion in dilute acids on the other hand. If these factors balance each other the corrosion is at a minimum (unstable condition). If the balance becomes upset either one type of corrosion or the other becomes predominating, and the corrosion proceeds towards a maximum. It is felt that a complete understanding of the unstable condition will throw some light on commercial corrosion problems. EF (13)

Corrosion Resistance of Cast Hydronalium (Korrosionsbeständigkeit von Hydronaliumguss) G. SIEBEL. *Aluminium,* Vol. 18, Oct. 1936, pages 511-518. Al-Mg alloys possess excellent resistance to sea water and brines because of the low potential differences between the phases existing in the highly alloyed material. Microsegregation during melting, however, may induce subsquent corrosion susceptibility; this can be minimized by the addition of Si up to 1%. See *Metals and Alloys,* Vol. 6, July 1935, page MA 372 R/1. Ha (13)

Vacuum Deaeration Combats Cold-water Corrosion. SHEPPARD T. POWELL & HOMER S. BURNS. *Chemical and Metallurgical Engineering,* Vol. 43, Apr. 1936, pages 180-184. Corrosion in
1 a welded steel pipe line 9 miles long, handling approximately 4,000,000 gals. water/day, reduced the capacity 22% in 129 days. Protective silicate scale was not successfully applied. Following practice established at Coolgardie, Australia, deaeration through mechanical means was tested and found to be applicable. Vacuum
— is maintained at 28 to 28.5" of Hg with a dry vacuum pump of 39% overall efficiency. This reduced dissolved oxygen content to 0.33 p.p.m. or 95% removal. No tubercles formed on test pipe in 3 months. Corrosion observed was not serious even in the presence of mill scale. The remaining O is removed with Na_2SO_3
2 at a cost of $1.00/million gals. Over a period of 8 mo. the plant has operated at constant capacity. 4 references. PRK (13)

— **Tube Corrosion in the Sugar Industry (Die Rohrkorrosion in der Zuckerindustrie)** I. W. KÖHLER. *Korrosion & Metallschutz,* Vol. 12, Nov. 1936, pages 312-332. The corrosion phenomena peculiar to this industry are discussed, tests described, and colored and black-white reproductions of corroded materials shown. Brass
3 with 70% Cu, brass with 0.4% Cr and brass with 1% Ni gave best results against attack. 60 references. Ha (13)

— **Damage by Corrosion in Beet-sugar Factories (Korrosionsschäden in Rübenzuckerfabriken)** H. CLAASSEN. *Korrosion & Metallschutz,* Vol. 12, Nov. 1936, pages 305-307. Corrosion of materials in sugar factories is discussed, and some preventive measures described. Ha (13)

4 **Brass Tubes in the Cane-sugar Industry of Java (Messingrohre in der Java-Rohrzuckerindustrie)** P. HONIG. *Korrosion & Metallschutz,* Vol. 12, Nov. 1936, pages 310-312. Destruction by corrosion of the brass used in this industry is discussed. Good results
— were obtained when the brass contained at least 70% Cu; Pb must not exceed 0.075%, Fe 0.06%. The structure must be homogeneous with an average grain size of 0.03-0.04 mm. Ha (13)

5 **Corrosion in a Beet-sugar Plant.** *Iron & Coal Trades Review,* Vol. 133, Nov. 27, 1936, page 946. Report No. 13 of the Corrosion Committee states that according to observations, corrosion by the liquids and juices in a sugar plant is worse in diluted state,
— and that when the juice becomes thicker little corrosion occurs. Corrosion occurs chiefly at the waterline; Cu-steels being no more resistant than ordinary steel. Si-Fe has proved best and P-bronze also behaved well. Ha (13)

6 **Electrolytic Corrosion in Buried Cast-iron and Steel Pipes, and Means Adopted in Practise to Diminish its Effect (Le corrosioni elettrolitiche nelle tubazioni interrate di ghisa e di acciaio, e i metodi adottati nella pratica per diminuirne l'entita)** O.
— SCARPA. *La Metallurgia Italiana,* Vol. 28, Sept. 1936, pages 425-443. Sections of steel pipes in the aqueduct at Cornappo were protected by 2-3 mm. thick layer of asbestos cement, then several layers of heavily tarred paper, and, finally, a second layer,
7 3-4 mm. of asbestos cement. This covering protects the steel from stray electric currents. Sections dug up after 2 yrs. were in excellent condition. Part III, pages 487-501. General conclusions. The aqueduct of Cornappo, which is exposed to stray electrical
— current from the electrification of the street car system, has been successfully protected against corrosion. See *Metals and Alloys,* Vol. 7, Dec. 1936, page MA 610L/1. AWC (13)

8 **Principles of the Modern Theory of Corrosion and Corrosion Passivity and Their Application to Problems of Surface Protection of Metallic Materials (Die Grundlagen der modernen Theorie der Korrosion und der Korrosionspassivität und ihre Anwendung auf Fragen des Oberflächenschutzes metallischer Werkstoffe)** W. J. MÜLLER. *Berg- und Hüttenmännisches Jahrbuch,*
— Vol. 84, Aug. 28, 1936, pages 55-62. The economical importance of metallic losses by corrosion is commented on and the means are reviewed to suppress or reduce corrosion to the least possible
9 degree. The scientific bases for rust and corrosion phenomena are discussed, the electrochemical reactions and formation of local elements which now are considered as causes of corrosion explained. Modern views are that the metal is made passive by a covering
— layer on its surface, and that the time which is required for passivation is, for the same current, inversely proportional to the free (i.e. not yet passivated) surface of the metal at the beginning; for the same initial surface, the passivation time decreases with increasing current. The covering layer is formed by gases adsorbed
10 by the metal on its surface; the higher the evaporation temperature of a gas or vapor the stronger the adsorption. Measuring methods for local currents and extent of passivated surfaces by determination of the potentials of local elements are explained. Ha (13)

After several years of intensive research, experimentation and testing, The Timken Company has developed an alloy steel in which part of the contained carbon is present in the form of free graphite.

This product, which has been named Graphitic Steel, has many unique properties. It combines the more desirable features of cast iron with the high strength of steel, responds satisfactorily to heat treatment and can be hot forged or rolled with ease at temperatures up to 2000° F.

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14. APPLICATION OF METALS AND ALLOYS

Many Developments in Metals and Alloys. *Product Engineering,* Vol. 7, Nov. 1936, pages 424-429. Recent developments in high-tensile, alloy, heat-resisting, abrasion-resisting and stainless steels, and non-ferrous alloys are reviewed and their properties briefly described. Ta is finding many commercial applications because of its extreme ductility and high corrosion resistance. A substitute for Pt is an alloy of 73% Ni, 17% Co, 7% Fe, 2.5% Ti and about 0.4% Al (which, however, enters only as impurity in the ferro-titanium used). The tensile strength is about 102,000 lbs./in.^{2}, and at 1160° F. 66,000 lb./in.^{2}, it has an extremely high corrosion resistance, and a higher electron emissivity than Pt. Another alloy, used for welding electrodes because of its high hardness, electrical and thermal properties is 99% Cu, the remainder Cr and Ag in the ratio of 8:1; the hardness is 150 Brinell. Recently developed bearing alloys consist of Cd-Ag-Cu and Cd-Ni. Ha (14)

Cylinders for Very High Pressures. D. M. NEWITT. *Mechanical World & Engineering Record,* Vol. 100, Oct. 2, 1936, pages 319-320. Shrinkage and wire winding have been applied to the development of reaction vessels for pressures up to 15,000 atm. WH (14)

14a. Non-Ferrous

G. L. CRAIG, SECTION EDITOR

Modern Applications of Rare, Recently Developed Metals (Moderni Impieghi di Metalli rari o recenti) A. GUZZONI. *Industria Meccanica,* Vol. 18, Nov. 1936, pages 679-683. Properties of Dowmetal, Electron, Be alloys, and fields of application of Ti, Bi, Ce, Co, Ta, W, Os, Th and Ur are discussed. Ha (14a)

Zinc-Alloy Die Castings Prominent in 1937 Cars. HERBERT CHASE. *Iron Age,* Vol. 138, Nov. 12, 1936, pages 34-37, 114. Considers some of the more important die castings used in latest automobile models. The die cast, Zn-alloy radiator grille continues as the most conspicuous die-cast element. Brackets for both head and tail lamps are die cast. A relatively new application of die casting is the hub for banjo type steering wheel with flexible steel spokes. Other die cast parts are louvers, horns and exterior and interior hardware. VSP (14a)

Aluminogel, Its Production and Properties (Aluminogel, dessen Herstellung und Eigenschaften) H. BRÜCKNER & L. HIRTH. *Angewandte Chemie,* Vol. 49, June 6, 1936, pages 360-362. A method of preparing an amorphous Al oxide, aluminogel, which is similar to silicic acid gel, which has a glassy hard structure maintained under adsorption of water and subsequent regeneration by heating to 400°-00° C., is described. Aluminogel can be used to remove humidity from gases; it can adsorb about 40% higher than silica gel. Ha (14a)

New Tramcar in Lightmetal of the Tramway of Milan (Nouvelle Motrice en Métaux légers des Tramways de Milan) R. FERRARI. *L'Allégement dans les Transports,* Vol. 5, Sept.-Oct. 1936, pages 114-121. The frame of the 14 m. long body of the car is built up in sections of Avional (3.8% Cu, 0.5% Mg, 0.5% Mn, Al remainder). Many parts of the body are of cast Duralite (3% Cu, 1.5% Fe, 0.5% Ni, 0.7% Si, 0.2% Ti, Al remainder). Axle-boxes consist of the same alloy, bumpers of forged Avional. HR (14a)

Aluminum in Rolling Stock Construction. E. V. PANNEL. *L'Allégement dans les Transports,* Vol. 5, Sept.-Oct. 1936, pages 129-132. Reproduced from the Railway Gazette London, Mar. 1936. See *Metals and Alloys,* Vol. 7, Sept. 1936, page MA 472R/3. HR (14a)

Corrosion Resisting Nickel Alloys. HAROLD E. SEARLE. *Canadian Chemistry & Metallurgy,* Vol. 20, Nov. 1936, page 355. A review. Corrosion resisting Ni products include: pure Ni, Monel Metal, Inconel, and stainless steel. WHB (14a)

The Application of Light Alloys in General Engineering. G. A. CLAVEY. *Metal Industry,* London, Vol. 48, Feb. 7, 1936, page 188. See *Metals and Alloys,* Vol. 7, Dec. 1936, page MA 610R/10. HBG (14a)

14b. Ferrous

M. GENSAMER, SECTION EDITOR

2 **Pressed Steel Bathtubs—Three Decades of Development Climaxed by Modern Enameled Sanitaryware.** A. H. ALLEN. *Steel,* Vol. 99, Aug. 31, 1936, pages 34-38. Based on interview with C. J. RODMAN. Traces development of porcelain enameled steel bath-tub and describes practice of Alliance Porcelain Products Co. Present excellence of tub is due to marked improvement in workability and surface finish of steel sheets, perfection of automatic
3 electric welding methods for flash welding of sheets, building of heavier presses, working to closer limits, and design of suitable dies for drawing of shells in which no serious thinning down of metal is found and in which no critical stresses are set up at corners and bends. Standard enameling practice is used. Welded design is more economical than a single-piece tub. MS (14b)

4 **Low-Alloy Steel Used Extensively in 26 Cars for Delaware Bridge Service.** *Steel,* Vol. 99, July 13, 1936, pages 55-56. Structural members of passenger cars are of low-alloy high-tensile *"AW70-90"* steel, which provides high strength and added corrosion-resisting properties. MS (14b)

5 **The Manufacture of Electrically and Fire Welded Chain in South Africa.** W. GRANT MACKENZIE. *Journal of the South African Institution of Engineers,* Vol. 35, Oct. 1936, pages 54-60. A paper dealing primarily with the manufacturing operation. WHB (14b)

6 **Economical Manufacture of Spur Gears with Oblique Teeth with Regard to Wear and Noiselessness (Die wirtschaftliche Fertigung von Stirnrädern mit Schrägverzahnung in bezug auf Verschleiss und Geräuschlosigkeit)** RICHARD KOCH. *Automobiltechnische Zeitschrift,* Vol. 39, Sept. 25, 1936, pages 464-468. Materials for gears and their heat treatment are discussed, modern gear-cutting methods and measuring methods for wear and noise described. An air-hardening material is composed of 0.4% C, 4-5% Ni, 1-1.5% Cr, 0.8% Mn, 0.3% Si, 0.03% P and 0.03% S; tensile strength 130-150 kg./mm.^{2}, elongation 5-7%. A case-hardening steel has a composition of 0.15% C, 0.5% Mn, 0.3% Si, 0.7% Cr, 3.5% Ni, 0.03% P, 0.03% S; core hardness 120-140 kg., surface hardness 60 Rockwell. The heat-treating and hardening process for both steels is described in detail. Ha (14b)

7 **Chromium and Its Alloys.** W. J. PRIESTLEY. *Industrial & Engineering Chemistry,* Vol. 28, Dec. 1936, pages 1381-1385. Discussion, V. B. BROWNE, pages 1385-1386. Discussion of Chromium-Bearing Steels in Pressure Vessel Construction, R. K. HOPKINS, pages 1386-1387. Discussion, E. C. WRIGHT, page 1387. General Discussion, H. L. MAXWELL, page 1388. Discussion of New Metals in the Pulp and Paper Industry, J. D. MILLER, pages 1389-1390. Presented before the Division of Industrial & Engineering Chemistry of the American Chemical Society
8 at the Pittsburgh Meeting, Sept., 1936. Cr and its alloys have desirable characteristics when used in the chemical industry, but slight variations in conditions and in chemical compounds sometimes materially influence the degree of satisfaction that a Cr-bearing metal can give in service. The properties and special applications of Cr-steels are discussed in the order of increasing content of Cr (1%-30%). This article with its discussions gives a vast amount of information concerning the types of material that may be safely used in equipment made of the various alloys and usually gives the temperature for safe processing, pressure limita-
9 tions and effects on the alloys of additions of small amounts of other elements. MEH (14b)

Radio Production at All-Time High, But Steel Requirements are Lighter. *Steel,* Vol 99, Aug. 3, 1936, page 20. Tonnage of steel used in radio sets is less than in pre-depression years, due to trend toward smaller and more compact units. MS (14b)

10 **Bicycle Boom Taking 15,000 Tons of Steel This Year.** *Steel,* Vol. 99, Aug. 31, 1936, page 19. It is estimated that American production of bicycles in 1936 will amount to 1,000,000 machines, requiring 15,000 tons of steel. Frames are about 19-gage electrically welded tubing. Frame connections are 12-gage metal stampings. MS (14b)

15. GENERAL

Accident Experience in the Steel Industry 1935. *Blast Furnace & Steel Plant,* Vol. 24, Sept. 1936, pages 801-802; abstract in *Steel,* Vol. 99, Aug. 31, 1936, page 80. Report of National Safety Council. 1935 average frequency rate of 8.86 (no. of disabling injuries per 10^6 man-hrs. of exposure) is 18% below 1934 rate. Corresponding average severity rate of 2.04 (no. of days lost per 10^3 man-hrs. of exposure) is 1% below 1934 rate. Steel industry ranks 7th in accident frequency among 30 major industries and 25th in severity. Frequency rates are lowest in large mills and severity rates are lowest in small plants. Skelp mills have highest frequency rates, averaging 19.88, while open-hearth plants have highest severity, 4.85. MS (15)

A New Canadian Ferro Alloy Plant. *Canadian Chemistry & Metallurgy,* Vol. 20, Oct. 1936, pages 320-321. A description of the plant of St. Lawrence Alloys, Ltd., at Beauharnois, Quebec. The plant is provided with space for 3 furnaces of 5000 h.p. each; 50% and 75% ferro-silicon are made. WHB (15)

Metallurgist's Role In Steel Making Takes on Growing Importance. H. W. GRAHAM. *Iron Age,* Vol. 138, Oct. 1, 1936, pages 41, 45H. VSP (15)

Patents as Industrial Property. W. A. SYLVESTER. *Chemistry & Industry,* Vol. 55, Nov. 13, 1936, pages 909-916. Excellent paper on national rulings, costs, etc., in obtaining letters of patent in the principal countries of the world,—U. S. A., Great Britain, France and Germany, and also in the smaller nations. The legal procedure and points of law in practically every country, regardless of size, are detailed. The nature of the subject matter is entirely too complex and detailed for an abstract. Reference to the original paper is highly recommended. AAA (15)

Electrical Control of Chemical Processes. A. D. ELMSLY & MUCHLON. *Chemistry & Industry,* Vol. 55, Dec. 4, 1936, pages 969-974. Excellent paper containing much information and data on pH control in chemical processes. Complete description of apparatus is presented. AAA (15)

The Installation Factor in Automatic Controls. DOUGLAS W. HARRISON. *Chemistry & Industry,* Vol. 55, Dec. 4, 1936, pages 977-978. Installation instructions for automatic controls are given. AAA (15)

Microchemical and Special Methods of Analysis in Communication Research. BEVERLY L. CLARK & H. W. HERMANCE. *Bell System Technical Journal,* Vol. 15, Oct. 1936, pages 483-503. Gives a general but interesting review of a type of chemistry whose industrial importance has been overlooked until comparatively recently by American chemists. Many standard analyses have been reduced to micromethods in which the same accuracy is attained on 5-mg. samples as was previously attained on ½-gr. samples. Examples are taken from the telephone industry of analyses where only minute samples are available. HFK (15)

Vacuum Technique Fundamentals for the Chemical Laboratory (Grundlagen der Vakuum technik für das chemische laboratorium) G. MÖNCH. *Chemiker Zeitung,* Vol. 60, June 6, 1936, pages 465-468. Although the purpose of this article is to acquaint chemists with vacuum technique, it should be useful to metallurgists, who are becoming increasingly interested in the possibilities in vacuum melting, pouring, etc. The construction and application of hydraulic pumps (10-20 mm. Hg pressure) rotary oil pumps (.10 mm. Hg), mercury vapor pumps (less than .01 mm. Hg), refrigerating pumps that condense the air and thus reduce the pressure, and cold (activated) carbon absorbers for removing the air are given. The Schenkel, Macleod and "chemical" manometers are described and illustrated, as are auxiliary parts such as stopcocks, vents, etc. FPP (15)

The Geochemical Frequency of Barium. C. J. VAN NIEUWENBURG & R. H. DEWALD. *Recueil des Travaux Chimiques des Pays-Bas,* Vol. 15, April 15, 1936, pages 263-266. In English. Continuing an investigation on the relative abundance of the alkaline earths in igneous rocks, the authors find—contrary to general opinion—the Ba content to be distinctly smaller than the Sr content. This result removes an apparent exception to the general rule, which holds that the geochemical frequency decreases towards the higher terms in a group of the periodic system. EF (15)

The Canadian Mineral Industry in 1935. JOHN MCLEISCH & STAFF. *Canada Department of Mines, Mines Branch Report* No. 773, 1936, 100 pages. A series of reviews including Al, Sb, Bi, Cd, Co, Cu, Au, Fe, Pb, Mn, Mo, Ni, Pt, Ra, U, Se, Ag, Te, Ti, and Zn. AHE (15)

Steel Castings and Their Contribution to Industrial Progress. RAYMOND L. COLLIER. *Steel,* Vol. 99, July 27, 1936, pages 36-37. General. MS (15)

15a. Economic

Developments in Physical Chemistry of Steelmaking and Their Importance to Industry. T. G. BAMFORD. *Iron & Coal Trades Review,* Vol. 133, Oct. 9, 1936, page 614. Post-war developments in the usefulness of P in steels, problems of melting and refining, and the effect of fine grain on heat treating are discussed. Ha (15a)

Canadian Iron & Steel Industry. F. W. FIELD. *Iron & Coal Trades Review,* Vol. 133, Nov. 27, 1936, page 937. Report No. 655 of the Department of Overseas Trade compiles statistics on Fe and steel production, kind of products and facilities of the principal steel companies of Canada. See *Metals and Alloys,* Vol. 6, June 1935, page MA 261L/3. Ha (15a)

The Metal Content of Petroleum Coke and Fly Ash (Ueber den Metallgehalt des Petrolkokses und der Flugasche) FELIX HERMANN. *Metallwirtschaft,* Vol. 15, Nov. 20, 1936, pages 1124-1125. A report on the metal content of the residue left in the oil refining process and the metal content of the ash resulting from the burning of fuel oil in ships. GA (15a)

The Natural Occurence of Vanadium (Das Natürliche Vorkommen des Vanadiums) FELIX HERMANN. *Metallwirtschaft,* Vol. 15, Nov. 13, 1936, pages 1007-1015. The various sources of V are classified in 9 tables, under the headings V in volcanic matter, magmatic Fe ores, sedimentary Fe ores, Mn ores, sedimentary rock containing organic matter, graphite, petroleum, organisms and V minerals. Location of source and amount of V present are mentioned. 176 references. GA (15a)

Research as Applied to Manufacturing. C. W. MEYERS. *Wire & Wire Products,* Vol. 11, Oct. 1936, pages 561-564. The economic soundness of research work in technological improvement is discussed. Ha (15a)

High Price Helps California Quicksilver. J. B. HUTTL. *Engineering & Mining Journal,* Vol. 138, Jan. 1937, pages 3-6. About 1000 flasks of Hg per month are being produced in California. WHB (15a)

15b. Historical

The History of the Metal Microscope (Zur geschichte des Metallmikroskops) H. FREUND. *Giesserei,* Vol. 23, Sept. 11, 1936, pages 491-502. Purpose, principles, types and application of metallurgical microscopes are described historically. Ha (15b)

The Witwatersrand Gold Mining Industry and Its Metallurgical Development. T. K. PRENTICE. *Journal Chemical, Metallurgical & Mining Society South Africa,* Vol. 37, Aug. 1936, pages 27-36. Development of Rand metallurgical practice described. AHE (15b)

Utility Buying of Copper. CORNELIUS F. KELLY. *Metals,* Vol. 7, Sept. 1936, pages 7-9. The author, president of Anaconda Copper Mining Co., reviews the future of the Cu market. ROS (15b)

Central African Copper Belt. *Metals,* Vol. 7, Sept. 1936, pages 10-15. The history of the development of the Central African Cu belt is given. The plants and mining equipment have cost more than £10,000,000 to erect and enable the area to produce annually 200,000 tons of Cu. ROS (15b)

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POSITION WANTED: Physical Metallurgist desires change from development work to teaching or research. Thoroughly trained in Physical Metallurgy, Doctorate from Eastern School, Publications. Seven years' industrial experience and some teaching experience. Box MA-34, METALS & ALLOYS, 330 W. 42nd St., New York, N. Y.

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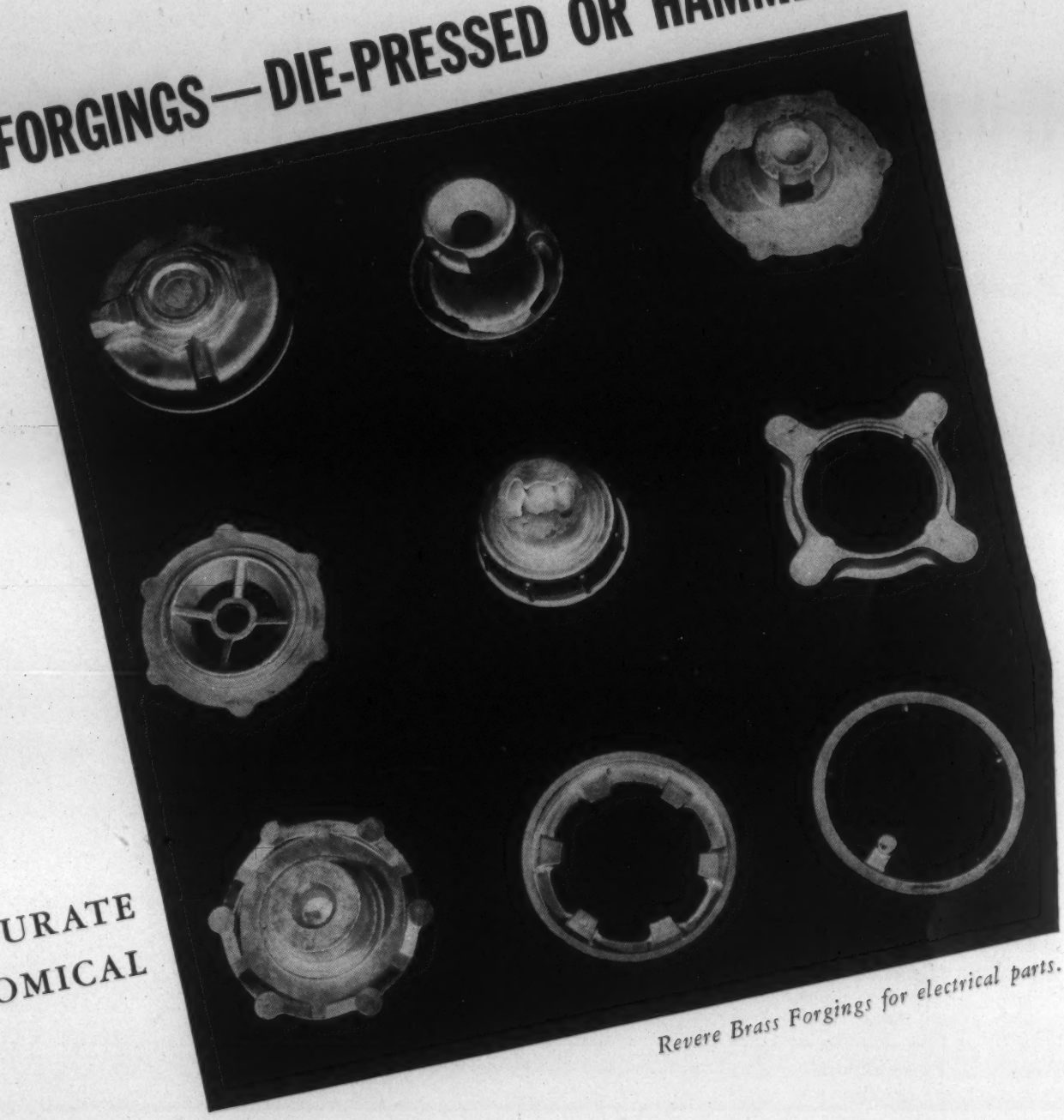

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Current News Items

Committees of A.S.T.M. Meet

The annual spring group committee meetings of the American Society for Testing Materials, held at the Palmer House in Chicago, March 1 to 5, was a very successful affair. Attendance was very large, fully equalling the record meeting in Pittsburgh in March, 1936. There were over 500 committeemen present, partaking in sessions of their respective committees. Facilities afforded by the layout of the Palmer House for committee rooms were generally approved. The usual routine business of perfecting and drawing up specifications and of prosecuting research activities was the chief work of the meeting. Most of the Society's committees on ferrous and non-ferrous metals and alloys were in session.

The regular Regional Meeting was held during the week. This usually is featured by a symposium. This year there were two symposiums, one on "Procedure in Corrosion Testing" and the other on "Lubricants." The corrosion testing symposium was made up of six papers—much too long a program for an evening's session. All day Wednesday, March 3, was given to the symposium on Lubricants.

For information on the proceedings of the committees and the various papers at the symposiums, the society's publications must be consulted.

Annual Spring Meeting of Electrochemical Society

The annual spring meeting of The Electrochemical Society will be held in Philadelphia April 28 to May 1 at the Hotel Benjamin Franklin. Two important symposiums are scheduled, one on "Electrochemical Methods in Biology" and one on "Industrial Catalysis." There will also be a session on "Electrode Phenomena in Aqueous Solutions" and another on electro-organic and miscellaneous papers.

For the evening of April 29 a popular lecture has been arranged, open to the public. It will be delivered by Dr. Detlev W. Bronk on "Electrical Methods in the Study of Nerve and Muscle."

Plant visits will include the Edward G. Budd Mfg. Co. and the Leeds & Northrup Co.

International Testing Society to Meet in London

The International Society for Testing Materials will hold its International Congress in London, England, April 19 to 24. An extensive program has been arranged in which leading authorities of several different countries will be represented. The general topics under which the various papers are listed are as follows:

Behavior of Metals (Mechanical and Chemical) as Dependent Upon Temperature, Particularly High Temperatures.
Progress in Metallography.
Light Metals and Alloys.
Wear and Machinability.

"Other subjects included are inorganic and organic materials.

● A new district sales office has been established at Indianapolis, Ind., by The American Rolling Mill Co., Middletown, Ohio, according to a recent announcement by the company. Offices will be located in the Circle Tower. Austin Edwards, for many years associated with the Middletown sales district, has been named manager of the new Indianapolis district. His territory will embrace a large section of Indiana.

A.S.M.E. To Hold Semi-Annual Meeting in Detroit

Plans for the 1937 Semi-Annual Meeting of the American Society of Mechanical Engineers, to be held at Detroit, May 17 to 21, with headquarters at the Statler Hotel, were advanced to a point where the tentative program has been announced. The papers committee, which is headed by Harry T. Woolson, executive engineer of the Chrysler Corp., has set up a series of six general sessions which will be held on the mornings and evenings of Tuesday, Wednesday, and Thursday, culminating in a dinner scheduled for Thursday evening. On the afternoons of these same days plant visits and simultaneous sessions of the various professional divisions are to be held. At the general sessions, eminent authorities from the engineering and industrial fields of the Detroit area will develop a broad survey of the modern techniques employed by the mass-production industries typified by the automobile builders, and the special technological problems in which lie the varied interests of the professional divisions.

Symposium on Steelmaking

The Council of the Iron and Steel Institute (British) announce that arrangements are in progress for the holding of a Symposium on Steelmaking in connection with the annual meeting in May, 1938. The symposium will be designed to provide opportunities for the discussion of the practical and theoretical aspects of steelmaking by all processes, but with particular attention to the acid and basic open-hearth processes.

Papers will be invited on: The design and layout of melting shops; furnace design and operation, including heat economy, etc.; steel manufacture, including casting, slag utilization, steelworks refractories, etc.; metallurgical reactions, including the physical chemistry of steelmaking, the constitution of slags, non-metallic inclusions, segregations, etc. Further information will be issued in due course.

World Conference on Steel Development in New York

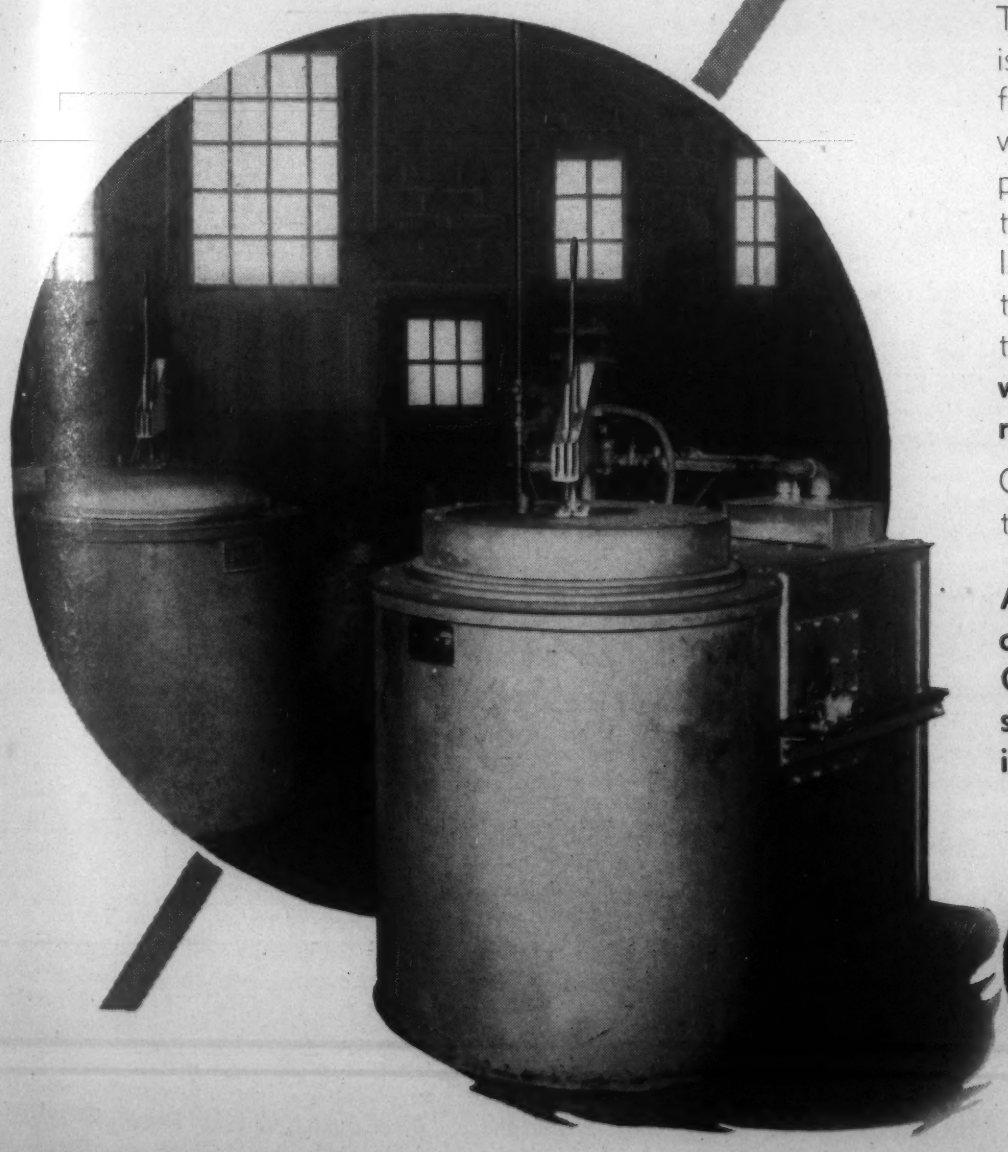
An international conference of delegates from all steel-producing countries will be held in New York June 28 to July 3. The American Institute of Steel Construction, 200 Madison Ave., New York, will be host. This will be the sixth International Congress for Steel Development. Five similar conferences held during the five previous years have all met in Europe, the last in Berlin, Germany, in 1936.

The purpose of these conferences is the exchange of information regarding improved methods of applying steel to construction and other uses, its object being to make the material better adapted to all the uses for which it is intended.

● Announcement is received from The Lincoln Electric Co., Cleveland, of the appointment of John S. Humble as arc welding consultant for the Boston Office, 10 High St. Mr. Humble has had considerable experience in the practical application of electric welding and will be available to arc welding users in the Boston territory for consultation on any question or problem about welding. Mr. Humble's work will be under the supervision of J. E. Raney, who is in charge of the Boston Office.

Certified* Economy Precision

This record of an actual plant production test covers 14 consecutive days' operation of a Gas-Fired Cyclone, as compared with the performance of a competitive furnace doing the same class of work. Installed for drawing chain link side plates and pins, the Lindberg Cyclone Furnace reduced steel tempering costs 26.5 per cent. Figured on a yearly basis, this represents a return on the investment of 35.6 per cent—sufficient to liquidate the cost of the Cyclone Furnace in less than three years.



The precision for which the Cyclone is famous is illustrated by the report on a production run for government work over a period of several weeks: "A government inspector tested the pieces to be sure the Brinell hardness was between 388 and 415. The charges consisted of link bars either ½" or 1" thick and long enough to reach from the bottom to well toward the top of the baskets. **Over 2000 of these bars were tempered in the Cyclone without one rejection."**

Control charts and uniformity tests, pictured in the Report, show how such precision is possible.

As a result of the operating economy and accurate heating control obtained from the Cyclone, the remaining old furnace has been scrapped and a second similar Cyclone unit installed to take its place.

*Copy of this Report by an independent engineering company available on request.

Lindberg CYCLONE Tempering Furnace

Lindberg Engineering Co.

218 UNION PARK COURT, CHICAGO, ILLINOIS

Offices in Principal Cities *Canada: Williams & Wilson, Ltd.*

A Traveling Exhibit of Flexible Finishes

The "Roxalin Trail Blazer," an interesting and comprehensive display of applications and tests of flexible lacquer coatings on metals and non-metals, has been completed, and will start "touring" very shortly under the auspices of the Roxalin Flexible Lacquer Co., Elizabeth, N. J.

The Trail Blazer itself is a 22 ft. long trailer, tastefully equipped, and finished in two shades of blue and aluminum. The displays present more than 200 parts and assembled products actually in commercial production, which have been finished with Roxalin flexible lacquer and synthetic coatings in a variety of styles, designs, colors and shades to stand every type of use and abuse, chemical and physical. Metallurgists will be particularly interested in the demonstrations of the resistance of these lacquers to corrosion and to abrasion, blanking and forming.

The interior of the trailer, illustrated herewith, is divided into several individual bays or displays, each a complete exhibit in itself. One shows the blanking and forming operations on discs previously finished with a Roxalin flexible lacquer. Another illustrates the maintenance of flexibility and adhesion of the lacquer to an aluminum fan blade after 2 yrs. exposure to steam in an oven. Another exhibit demonstrates the stages in producing lacquered-finished rolls of metal edging for boxes; the edging is made of strip steel, first coated with "Blue Knight" flexible finishes, then slit, perforated, and reeled; the reels are later assembled with paper box flats on automatic machines which form the angle and sink the projections into the box board. Metal name plates, dials, etc., attractively finished for automotive and other applications are shown. Steel tubes finished with one coat of "Roxyn C" are banged together without chipping, flaking or peeling. Samples of work done by a well-known etching company illustrate the application of "Ba-Flex" before the plating operation, which the finish successfully withstands.

The Roxalin Trail Blazer will present its story to manufacturers throughout the country. Visitors' comfort has been carefully considered in the seating arrangements and in the head-room and open space available.

New Appointments at Battelle

Frank Day has been appointed to the technical staff of Battelle Memorial Institute, Columbus, Ohio. Mr. Day is a graduate in chemistry of Ohio State University. He has been assigned to a project in chemical engineering.

E. J. Ramaley has also been appointed to the technical staff of the Institute. Mr. Ramaley comes to Battelle from the University of Colorado where he received the degree of M.Sc. in electrical engineering. He has been assigned to a research project dealing with the magnetic properties of alloys.

Howard L. Womochel is another appointee to the technical staff. He is a graduate in metallurgy of the University of Wisconsin and was formerly connected with the Burgess Parr Company. He has been assigned to the metallurgical division at Battelle.

The Lincoln Foundation Welding Contest

A copy of the brochure of the Lincoln Foundation prize contest has been issued. This very attractive document contains the rules and conditions governing the $200,000 contest and defines each industry classification in its contest application. It also lists typical machines, structures, buildings, manufactured and fabricated products which contestants may select as subjects for papers and some of the typical subjects are illustrated.

Porcelain Enamel Institute Forum

Plans for the first annual Porcelain Enamel Institute Forum are rapidly nearing completion. The Forum will be held May 5, 6 and 7 at the University of Illinois, and will be open to everyone in the porcelain enameling and related industries.

Prominent among the speakers at the Forum, in addition to the regular technical program, will be Robert G. Calton of the Tennessee Enamel Mfg. Co., president of the Institute, and the two Institute vice-presidents—F. E. Hodek, Jr., of the General Porcelain Enameling & Mfg. Co., and E. L. Lasier of the Titanium Alloy Mfg. Co. President Calton will make the response to an address of welcome to be given by the president or some other representative of the University of Illinois. Mr. Hodek, who is also chairman of the committee in charge of the Forum, will talk on "Forum Plans for 1938." Mr. Lasier's subject will be "The Institute and the Enameler." Mr. Hodek will make preliminary announcements regarding the 1938 Forum which is to be held at Ohio State University.

WPA Expenditures for Metal

The American metal industry has had in the WPA one of its most important customers, according to records of material purchases, with totals cumulative to February, 1937, reported to the division of research, statistics and records of this Federal Works Program agency.

Expenditures for metal products, including tools, for use on more than 50,000 construction projects operated in the 48 states, totalled $71,870,690.00 through Jan. 31, 1937—subject to minor revisions. Cast iron pipe and fittings lead the list of metal purchases with a total of $21,605,663. Second in total value comes structural and reinforcing steel with $17,846,999.

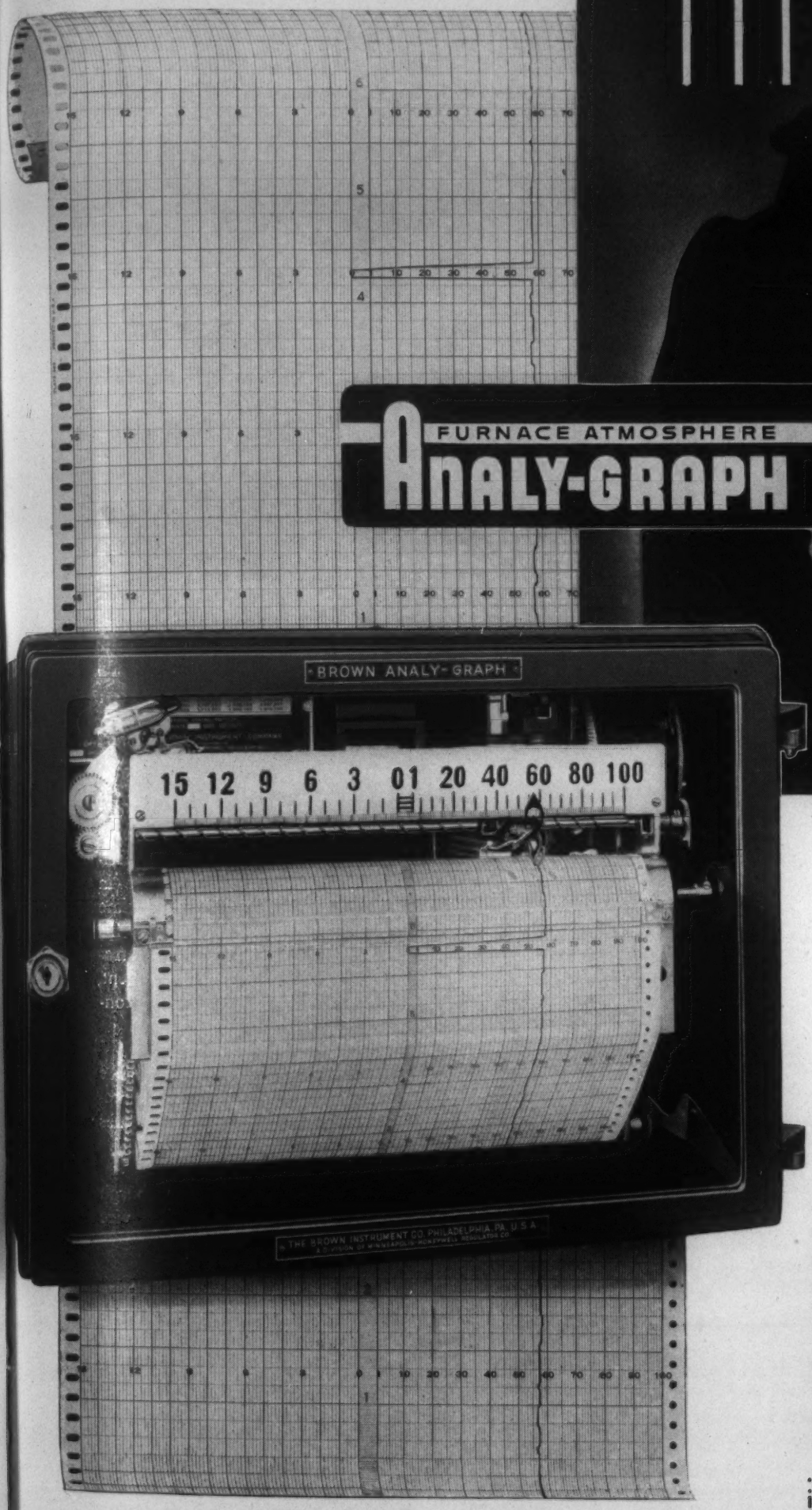
● The Salem Engineering Co., Salem, Ohio, announces the opening of its Salem Engineering Co. (England) offices at First Ave. House, High Holborn, London, W.C.1. The company now has orders on hand for a considerable volume of equipment and is manufacturing a regular line of products including the Salem circular ingot heating furnaces. It is probable that the London company will handle Continental and European business.

● E. Leitz, Inc., announces the removal of its headquarters in New York from 60 East 10th St. to the Heckscher Building, 730 Fifth Ave. The new quarters are exceptionally well-suited for carrying on its extensive business in microscopes and other optical instruments, as well as the well-known Leica cameras. Included are a large display room, a well-equipped projection and demonstration room, and many new facilities for increasing their service to customers.

● The ready acceptance of the Wheelco line of instruments—employing the revolutionary "No-Contact, Radio Principle"—by industry as a whole, has forced the Wheelco Instruments Co. to triple its space. Offices and manufacturing facilities have been moved to modern daylight quarters at 1929 South Halsted St., Chicago.

● Harry W. Dietert Co. announce the opening of the new plant located at 9330 Roselawn Ave., Detroit, fully equipped with new and modern facilities for the production of Dietert-Detroit sand, core and mold control equipment.

MEASURE FURNACE ATMOSPHERE



The ANALY-GRAPH is fool-proof, simple in operation and easily installed on any furnace—electric or fuel fired—wherein furnace atmospheres are controllable.

A constant sampling of the furnace gases directly in contact with the work is conducted by means of an analyzing unit. Briefly, the procedure is as follows:

Furnace gases are drawn through a sampling tube, drier and filter. The gases upon entering the **Gas Analysis Cell** cause the electrically heated cell to get hotter—increasing the electrical resistance. The rise and fall of electrical resistance with changes in furnace atmospheres affects the galvanometer in the recording instrument which produces a continuous record of oxidation or reduction.

Thus, the furnace man is supplied with a continuous record, on a standard 12-inch chart, of the furnace atmosphere as produced by any degree of combustion.

. . . *and you* CONTROL A VITAL FACTOR *in Heat Treating*

No longer need you wait for a report on the furnace atmosphere while work may be spoiling. Direct reading of the Brown ANALY-GRAPH measures furnace atmosphere in simple, workable terms. It gives accurate, unfailing response to variations in the atmosphere and humidity conditions—whether combustion is complete or incomplete.

To measure furnace atmospheres with the Brown ANALY-GRAPH—while work is being treated—is to **know in advance** that the final result **will exactly meet** the desired specifications. It means, further, that you can easily avoid faulty hardening . . . expensive retreatments . . . rejections due to excessive scaling, undesired carburizing or decarburizing.

The Brown ANALY-GRAPH enables you to check the exact amount of oxidation and reduction in the furnace atmosphere—for any metal—at any temperature. Thus, you have a tangible, instantaneous and continuous means of controlling quality and uniformity of result—a VITAL FACTOR in heat treating.

An outstanding advantage is that once the ideal condition is established and recorded, it can be quickly duplicated whenever desired—batch after batch—by any operator.

Other advantages and detailed descriptive data are given in Bulletin No. 92-1. Write THE BROWN INSTRUMENT COMPANY, *a division of Minneapolis-Honeywell Regulator Co.*, 4517 Wayne Avenue, Philadelphia, Pa. Offices in all principal cities. Toronto, Canada: 117 Peter Street—Amsterdam-C, Holland: Wijdesteeg 4—London, England: 70 St. Thomas' Street, S.E.1.

BROWN DIVISION INDUSTRIAL INSTRUMENTS

BROWN FURNACE ATMOSPHERE RECORDER

108,000 Sq. Ft. of Monel Metal for Library Roof

Millions of persons resident in the Metropolitan area of New York City and millions more who have visited the city in the past have noted the burnished copper roof of the great New York Public Library at Fifth Ave. and 42nd St. On days when the sun shone brightly, it was hard on the eyes.

Residents of the Metropolitan area and visitors to New York will no longer see the familiar landmark. It has been replaced by a Monel metal roof as a part of a WPA project for the general overhauling of the library.

The old roof had been badly corroded and was in constant need of repairs because of the vulnerability of the copper metal to the sulphur dioxide prevalent in the air of New York City.

Approximately 108,000 sq. ft. of Monel metal were required to complete the job. Replacement was made in 30-ft. sections, the wreckers barely keeping ahead of the roofing men, so that the interior of the library would not be unduly exposed.

Personals

● Dr. Janet Z. Briggs, assistant metallurgist to L. S. Bergen, research director, Crucible Steel Co. of America, New York, has been added to the staff of abstractors of METALS AND ALLOYS.

● Wesley P. Sykes, metallurgical engineer, Cleveland Wire Works, General Electric Co., Cleveland, has been selected to deliver the Howe Memorial Lecture at the National Metal Congress in Atlantic City, N. J., Oct. 18 to 22, 1937.

● John M. Watson, for many years a metallurgical engineer for the Hupp-Motor Car Co., Detroit, has found the Jones & Laughlin Steel Corp., and is located in the company's Detroit office. He has been very active in the A.S.M. having been successively treasurer (1928 and 1929), vice-president (1930) and president (1931).

● Francis B. Foley, manager, research department, Midvale Steel Co., Philadelphia, has been elected Chairman of the Iron and Steel Division of the American Institute of Mining and Metallurgical Engineers for 1937-1938.

● A. B. Phillips, metallurgist, American Smelting & Refining Co., Maurer, N. J., has been chosen chairman of the Institute of Metals Division of the American Institute of Mining and Metallurgical Engineers for 1937-1938.

● J. C. Joublanc has been made chief metallurgist for the Harnischfeger Corp., Milwaukee. For 10 yrs. he was connected with the Republic Steel Corp., and for 4 yrs. with the welding development and research department of one of the country's leading welding equipment manufacturers.

● Frank J. Enright has joined the A. F. Holden Co., New Haven, Conn., manufacturers and developers of heat-treating baths, as director of sales and advertising, according to announcement by A. F. Holden. Mr. Enright has resigned as advertising manager of *Metal Progress* and the American Society for Metals with whom he has been associated for the past 6 yrs. He began his advertising career over 20 yrs. ago with the McGraw-Hill Publishing Co. He was connected with *Power* and *American Machinist*, and, for several years, was McGraw-Hill's Detroit representative.

● W. L. Weaver has been appointed manager of stainless castings sales of Ludlum Steel Co., Watervliet, N. Y. Mr. Weaver has been associated with Ludlum for the last 20 yrs. as salesman, district sales manager for upper New York State, and more recently with the home office at Watervliet doing sales work of a development nature.

● C. H. Joy has been made representative of the Wheelco Instruments Co., Chicago, in the Pittsburgh district. He is a graduate of Clarkson College, Potsdam, N. Y.

● Dr. W. D. Coolidge and Dr. Irving Langmuir, director and associate director respectively of General Electric's Research Laboratory in Schenectady, and Dr. Evarts A. Graham of the School of Medicine of Washington University in St. Louis, were recipients of the John Scott 1937 awards granted by the City Trusts of the City of Philadelphia at a dinner of the American Philosophical Society in Philadelphia early last month. With each award went a certificate, a copper medal, and $1000 in cash.

The award to Dr. Coolidge was based on his application of a new principle in X-ray tubes; to Dr. Langmuir for his physical and chemical discoveries resulting in improved gas-filled incandescent lamps; and to Dr. Graham for his application of the X-ray to the study and diagnosis of gall bladder conditions.

In making the presentations, Ernest I. Trigg, chairman of the Board of City Trusts, explained that history had made but scant recordings of John Scott, the donor of the fund, and his reason for bequeathing to the City of Philadelphia in 1816 the sum of $4000, the income from which was to be "Laid out in premiums to be distributed among ingenious men and women who make useful inventions."

● H. F. Henriques and J. J. Lincoln, Jr., have been appointed assistant general sales managers of Air Reduction Sales Co., with headquarters in Cleveland and Pittsburgh, respectively. Mr. Henriques has been a member of the sales department of Air Reduction since March, 1929, and was manager of the Cleveland district from January, 1934, until he assumed his new position in January, 1937. Mr. Lincoln joined Air Reduction in 1924 and was appointed manager of the Pittsburgh district in May 1934.

● James G. Marshall, general superintendent of the Niagara and Welland plants of the Union Carbide Co., and the Electro Metallurgical Co., has been awarded the Jacob F. Schoellkopf Medal for 1937, according to an announcement by the Western New York Section of the American Chemical Society. Formal presentation of the medal, which is awarded by the Society annually for meritorious chemical achievement, will not be made until early in October as Mr. Marshall will be abroad in May, the usual time for the ceremony. The award to Mr. Marshall is a tribute to his notable technical contributions to the calcium carbide and ferroalloy industry, his untiring efforts in behalf of civic betterment, and his unceasing interest in the improvement of working conditions.

● Bruce B. Wallace has joined the staff of the Los Angeles office of The Foxboro Co., Foxboro, Mass., makers of industrial precision instruments. He will work out of Los Angeles as a sales engineer.

● C. M. Houck, formerly manager of inspection of the Pittsburgh Testing Laboratory, has been promoted to the office of vice president.

● Noble Jones, formerly connected with the Allegheny Steel Corp., in its West Leechburg plant for the past 15 yrs., has been made manager of the plant of the Barium Stainless Steel Corp., Canton, Ohio.

● J. A. Dwyer, manager of the Philadelphia branch of Crane Co., has been made district manager of all Crane branches in the Eastern territory, including all of the New England states, in addition to metropolitan New York, Eastern Pennsylvania, New Jersey, Maryland, and the District of Columbia. A total of 18 Crane establishments thus come under his jurisdiction. His headquarters will be at the company's New York branch.

● William A. Purtell has been elected president of the Billings & Spencer Co., Hartford, Conn. Frederick C. Billings, who has been president, has been made chairman of the board.

● James Allison, field science metallurgist for the Union Drawn Steel Co. in New York and New England, has been made factory manager of the Billings & Spencer Co., Hartford, Conn. Mr. Allison has also served as plant metallurgist of the former company, and worked at one time in the open-hearth department of the Crucible Steel Co. of America, in the finishing mills of the Jones & Laughlin Steel Corp., American Bridge Co., and the Niesta Machine Co.

FOR *Super*

TEMPERATURES..

NORTON REFRACTORIES

Photo from *General Electric Review*

ALUNDUM TUBES

IN molybdenum or tungsten wound electric furnaces where the call is for super-high temperatures, Alundum Tubes and Muffles are standard throughout the world. Made of Norton fused alumina and backed by Norton experience in the manufacture of this type of refractory, they have demonstrated their ability to meet sévere operating conditions.

Chemically they do not affect the heating element.

Physically their permeability allows maintenance of a reducing atmosphere throughout the furnace.

Electrically they are satisfactory because of their high electrical resistance even at elevated temperatures.

NORTON COMPANY, WORCESTER, MASS.

New York Chicago Cleveland

R-560

NORTON PRODUCTS—Grinding Machines; Lapping Machines ◆ Grinding Wheels; Abrasives for Polishing; India Oilstones, Pulpstones ◆ Laboratory Ware, Refractories; Porous Plates ◆ Non-slip Tiles and Aggregates

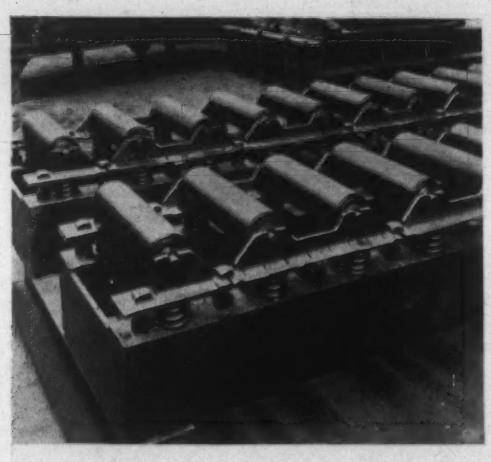
New Equipment and Materials

Shock-Absorbing Roller Conveyer

With the exception of improvements in bearing design there has not been a single major development of outstanding importance in the design and manufacture of ball bearing roller conveyers since their inception.

For over 30 years, roller conveyers have been built with the solid mountings and accepted as sound in principle and economical in cost and maintenance. The term "solid mountings" pertains to designs offered today which permit the rollers to freely rotate, but do not allow for movement either vertically or transversely. In other words rigidity prevails.

For many years a roller conveyer was used principally for conveying lumber, shingles, brick, packing, shipping, and tote boxes in warehouses. During the past decade many new



uses have been found for such conveyers and today they are essential in the large industrial plants,—for example, all types of foundries for transporting molds, castings, and groups of castings laid upon racks which in turn are carried upon roll conveyers. In one foundry 20-ft. long racks are placed on the roller conveyer; upon these racks are placed close together, cast side frames for railroad car trucks, the combined weight of the rack and side frames being as much as 12,000 lbs. Other examples of the use of roller conveyers for the conveyance of heavy material are found in the steel plants. Piles of sheet steel weighing up to 40,000 lbs. are conveyed on roller conveyers from one point of operation to another. Also, strip steel is now being rolled of sufficient width to form in one piece the tops of automobiles; this steel is rolled into strips hundreds of feet long and is subsequently coiled into huge coils in some cases weighing 25,000 lbs. and conveyed on roller conveyers.

The use of roller conveyers for handling heavy loads and the accompanying abuses resulting from the loading and unloading of the heavy material to and from the conveyers have necessitated marked advancement in the designs of the bearings and rollers of the conveyers. Naturally, the first step in keeping pace with the constantly increasing demands upon roller conveyers was to build the conveyers heavier consistent with the loads to be carried, but added strength in the conveyers did not overcome some of the more serious difficulties. This may be illustrated by an actual experience:

In a steel foundry a conveyer was installed for conveying molds weighing 8,220 lbs. The molds were 40-in. long and carried on metal skids, so the rollers were spaced on 4-in. centers in order that the mold at all times would be supported, theoretically by 10 rollers. With each roller carrying its proportionate share of the weight, the burden on each roller figured 811 lbs. By actual test it was found that, due to the mold having an uneven bottom and the skids being distorted, the load was carried by only 2 rollers, with the result that each roller supported 4,110 lbs. instead of 811 lbs. as theoretically calculated.

Assuming that the rollers used had a rated load carrying capacity of 1,000 lbs. each, obviously when imposed with a load of four times the rated capacity, bearing failures naturally would be expected, and that is what actually occurred.

A number of other tests were made and it was found that in every case the load was not evenly distributed. After having made extensive tests to determine the cause of bearing failures and high mantenance, the problem resolved itself into that of finding some means of causing each roller to carry its proportionate share of the load. All of this culminated in the invention of the "Mathews Shock-Absorbing, Resiliently Mounted Roller Conveyer" by the Mathews Conveyer Co., Ellwood City, Pa.

From actual tests and six months use in practice it has been conclusively proved that:

1. The Resiliently Mounted Conveyer has minimized the abuse of the conveyers and has thereby very substantially reduced maintenance cost.

2. With resiliency in the roller mountings each roller carries its proportionate share of the load; bearing friction is reduced to normal. The result of this is that the co-efficient of friction used to calculate the effort required to move loads over roller conveyer has been reduced considerably.

By actual test it has been found that heavy loads can be dropped upon the Shock-Absorbing, Resiliently Mounted Conveyer and that the springs will absorb the shock which, without the spring mountings, would be injurious to the bearings of the rollers. There are many places where the Resiliently Mounted Conveyor can be used to advantage besides those mentioned. In fact, in practically all industries a need arises for conveyers that can give, and take it.

The illustration shows this new development after six months test in actual practice in one of America's largest steel foundries.

Rectifier Provides New Source of Direct Current

"Copper Oxide Plate Type Rectifiers" provide a new, practical means of converting alternating current into direct current for use in the electroplating industry. This equipment is manufactured exclusively by the Hanson-Van Winkle-Munning Co., Matawan, N. J., in connection with the Westinghouse Electric and Mfg. Co.

The numerous sizes offered provide a wide range of direct current supply for use in electroplating operations. The unit consists of power transformers, a small fan for air circulation, the rectifier unit and necessary control equipment. The outfit is also equipped with a De-ion circuit breaker which serves both as a switch and a protection against overloads and short circuits.

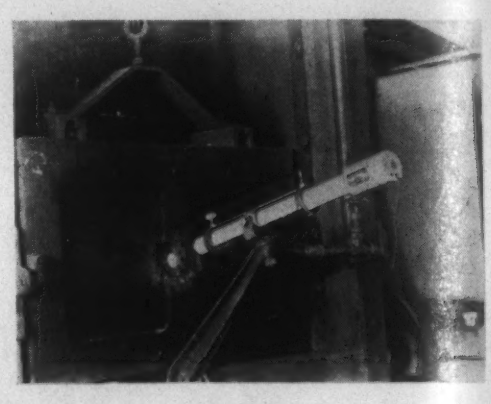
When installed where they are free from excessive humidity, dirt and fumes, it is said the equipment will give years of trouble-free service. Freedom from moving parts, except for a small ventilating fan, keeps maintenance costs of Copper Oxide Plate Type Rectifiers at a minimum.

Installation cost is practically nil as the outfit is simply placed into position as a self-contained unit. Additional features of this equipment include a high overall efficiency and high power factor.

"Rayotube"—A Temperature Detecting Device

The costly maintenance of ordinary thermocouples exposed to high temperatures, contaminating gases, and severe vibration is said to be eliminated in plants using a remarkably responsive detector which not only detects continuously the temperature of forge, slab, billet and heat-treating furnaces but, in some heat-treating shops, is actually detecting the temperature of the *work itself* as it drops off a conveyor into the quench.

Offered by Leeds & Northrup, Philadelphia, this detector—a "Rayotube"—is available in two models: A wide-angle type for large area temperature detection, and a narrow-angle type for temperature detection of smaller areas. Both mount in a safe, "cool" place just outside the furnace, and both, according to the maker, hold sensitivity and calibration re-



liably throughout their entire life even when operating alongside heavy hammers, or in the presence of contaminating gases.

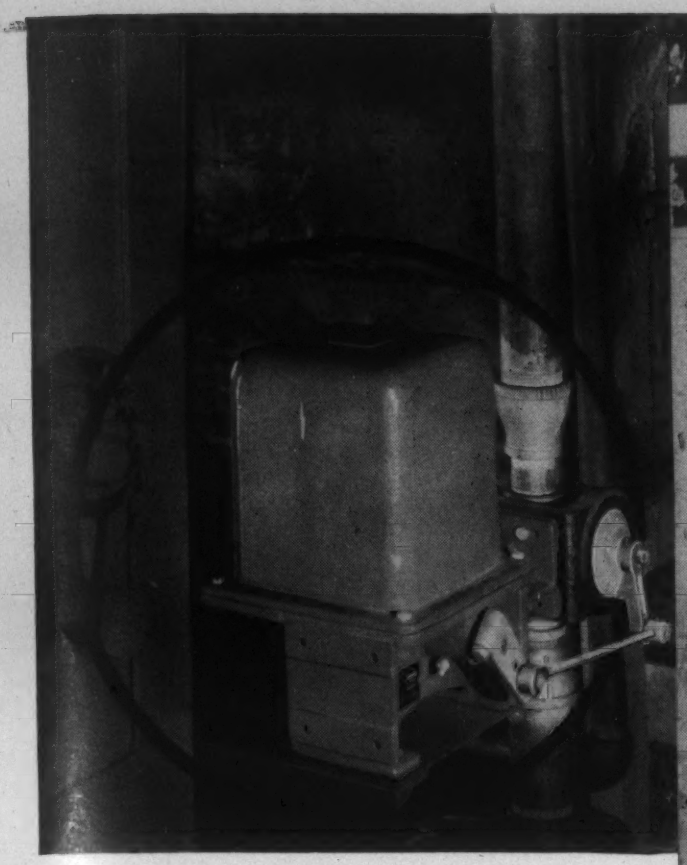
With Rayotube is used a standard Micromax which can continuously indicate and record temperature, and automatically operate signals or controls.

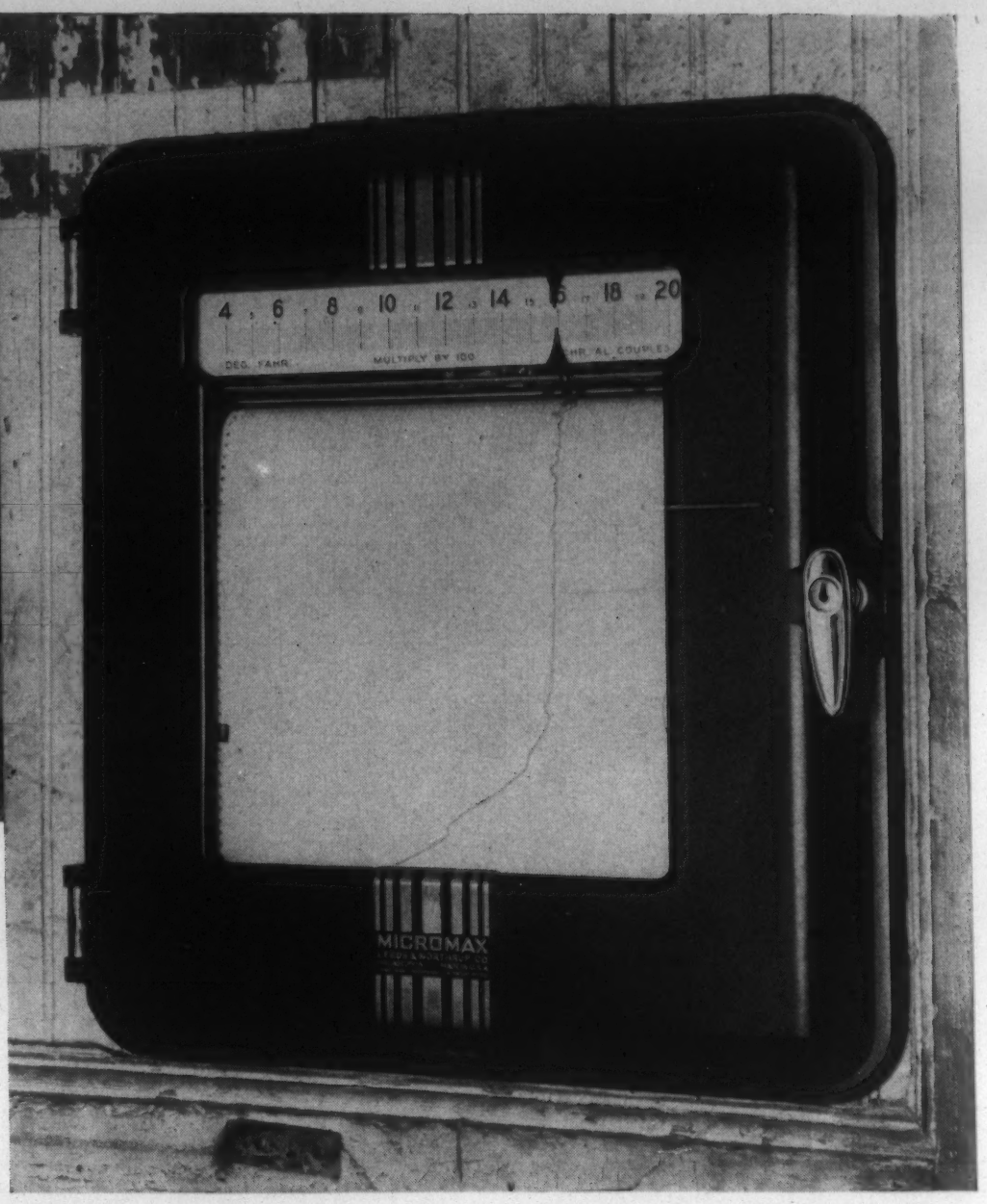
Six new illustrated folders describe the application of Rayotube equipment to quench zones, forge furnaces, high-temperature heat-treating furnaces, controlled-atmosphere heat-treating furnaces, slab and billet furnaces. Copies of any of these publications may be had by addressing Leeds & Northrup Co., 4934 Stenton Ave., Philadelphia.

New Primer Permits Color-Finishing of Chromium

Chromium is notably difficult to lacquer or enamel; in fact, no known type of air-drying lacquer will adhere to it satisfactorily. However, by the use of a new primer, recently developed by the Maas & Waldstein Co., lacquer and enamel manufacturers, Newark, N. J., chromium can be finished in any desired color.

The new product, known as "Chroprime," is a clear primer which can be applied to the metal surface by spraying or dipping, after which it is baked. It is said to adhere tenaciously to the metal and to provide an excellent foundation for any kind of lacquer enamel. It resists heat, remains flexible, and permits the metal to be engraved after it is applied. It is at present finding extensive application in the production of automobile name-plates and for other purposes where colors are wanted on a corrosion-proof base. Chroprime can also be used as a durable undercoat for finishing other metals.





Above—Note the simplicity and compactness of Micromax Electric Control's Valve Drive in the circle.

Right—Directing the Control is this Micromax Recording Controller.

Dependable REGULATION WITH MICROMAX ELECTRIC CONTROL

In spite of sudden changes in amount of material heated, the temperature of a process is held constant within a few degrees by Micromax Electric Control. Promptly adjusting fuel to each minute change in temperature, the Control improves uniformity, makes for smooth, efficient operation.

Merely turning a rheostat changes the "throttling range" (the temperature change required to cause full motion of the valve) as much as is necessary to fit the Control to the individual process. There are no re-adjustments to linkages or gears. Even when large changes occur in the amount of material to be heated, the Control can be adjusted either manually or automatically to retain closest heat balance and consequently closest temperature control.

J-N00A(3)

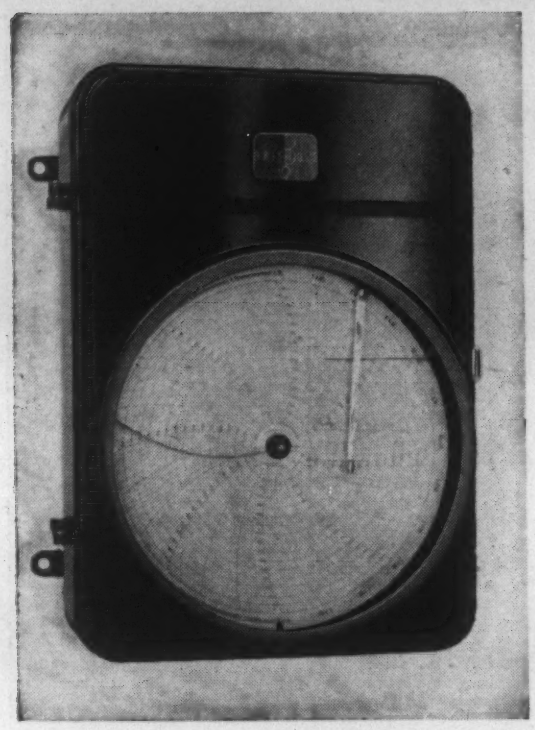
LEEDS & NORTHRUP COMPANY
4925 STENTON AVENUE PHILADELPHIA, PA.

LEEDS & NORTHRUP

MEASURING INSTRUMENTS - TELEMETERS - AUTOMATIC CONTROLS - HEAT-TREATING FURNACES

New Round-Chart Bristol Potentiometer

A new recording potentiometer of the round-chart type, known as the "Pyromaster," has been developed by The Bristol Co., Waterbury, Conn. This recording potentiometer is available as a pyrometer, tachometer, resistance thermometer, millivoltmeter, and milliammeter and operates on an entirely different



principle, which makes possible a number of very important exclusive features.

The Bristol Pyromaster requires no lubrication whatever; it is not affected by normal plant vibration; there is no mechanical motion of any kind except when a change in the measured quantity takes place; and it can be used under exceedingly rough plant conditions where the air is laden with dust, moisture, and corrosive fumes. The operating mechanism is made up of five small, compact units which are replaceable. There are no mechanical connections of any kind between the galvanometer unit and the other units.

The extreme simplicity of the principle used in the Pyromaster makes it possible to place the entire mechanism in a standard Bristol Model 40M case, the same case that is extensively used for recording thermometers, pressure gages, flow meters, and liquid level gages. The pen is actuated in such a way as to follow changes in the measured quantity as they occur and at a rate dependent upon the rate of change.

The Dietert Clay Washer

The "Clay Washer," a product of the Harry W. Dietert Co., Detroit, automatically washes the A. F. A. clay substance from molding sands. The tedious intermittent hand syphoning is eliminated, saving considerable labor, and eliminating the human equation. The time required to wash the sand sample is also reduced.

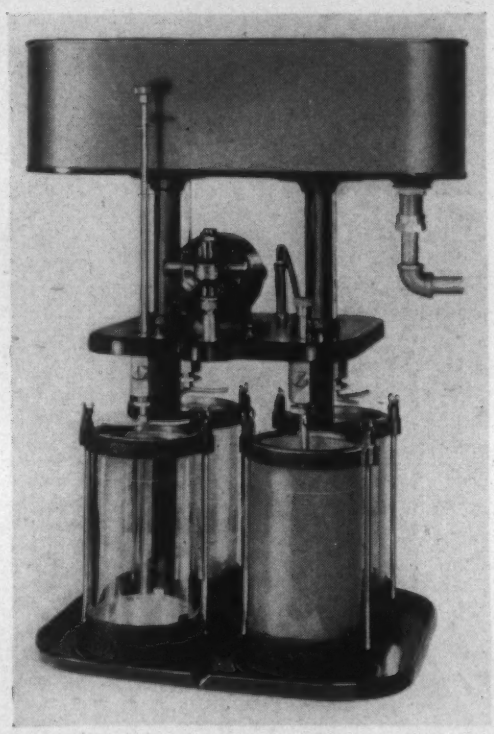
Four samples may be washed at one time. Wash bottles with removable bottoms are furnished so that the clay free sand grains may be removed from wash bottles without filtering and dried in oven.

The Clay Washer consists essentially of the following: A base receiving the four wash bottles; two supporting posts with a table on which is mounted the motor and drive mechanism to rotate the four washing tubes immersed in the sand sample; a water tank containing a float valve to maintain a constant level of water in tank.

The principle of operation is simple. Water from the tank travels through the posts to the stirring tubes which are rotated and immersed in the sand sample. The water leaves these tubes in a four-pronged crow foot located at the bottom of the tubes. This causes water to wash the clay out of the molding sand. The rate of water flow is such as to cause water to flow upward in wash bottles at the rate of 1 in. per min. Sand particles larger than 20 microns will fall faster than 1 in. per min., so that the water will carry out of the water bottle only particles 20 microns and smaller. The standard A. F. A. syphoning principle is reversed in the Clay Washer, thus yielding testing results within practical tolerances. The water carrying the clay substance flows over the top of the wash bottles and drains out of the base of the Clay Washer.

A thermostatic water heater is mounted in the water tank to maintain a water temperature of 75 deg. F. Distilled water is recommended for research tests, while tap water may be used in certain localities for control tests. The float valve will operate against water pressure up to 75 lbs. per sq. in.

The Clay Washer is a practical and valuable apparatus for both sand producers and foundries to enable them to obtain the percentage of A. F. A. clay substance contained in molding sands. The percentage clay content is a valuable test figure in the purchasing, shipping, and plant control of molding sands. The Clay Washer, by making this test simpler, will do much toward increasing the use of this sand test figure, it is claimed.



Tamms Pyramid Pyrometer

After months of exhaustive tests in many prominent foundries, under every possible working condition the Tamms Silica Co., Chicago, introduces its new "Pyramid Pyrometer." It works on the thermo-electric principle and features convenience of adjustment. Perfect calibration is maintained constantly by virtue of thumbscrew adjustment on face of the dial. Foundrymen will instantly recognize the value of this new feature because heretofore it has always been necessary to send this type of instrument back to the factory for check-up to maintain its accuracy.

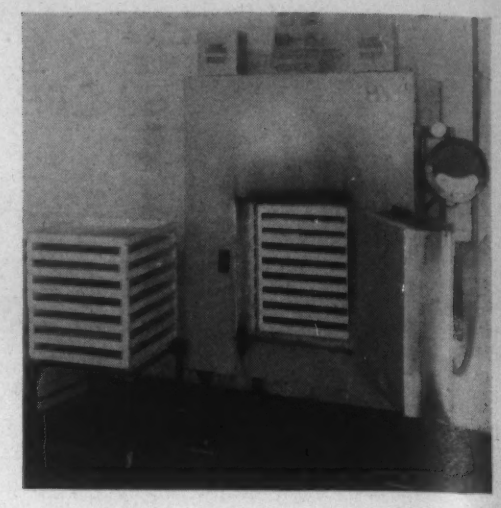
Another attraction is the new flexible end, adjustable to 180 deg. with perfect calibration assured. Customary swivel joints and brush or friction contacts have been eliminated thus minimizing the possibility of dirt deposits that hamper accurate readings. All electrical parts and connections have been enclosed for positive protection. All parts are inter-changeable for economy of maintenance.

Another feature is the pistol grip handle, which not only means comfort and ease of handling to the operator but a handle so unique in construction that it houses the accurate, delicate mechanism of the pyrometer. The pistol grip handle and indicating dial are arranged at such an angle that quick accurate readings without eyestrain or cramped posture are possible.

The new Pyramid Pyrometer is accurate, light in weight, and easy to operate. It is priced at $40.00 (f.o.b. Chicago), which includes thermocouple tip for either brass or aluminum. The manufacturer has prepared interesting literature describing it in detail.

Despatch Cross Flow Forced Draft Furnace

A "Despatch Cross Flow Forced Draft Duralium" treating oven is offered by the Despatch Oven Co., Minneapolis, Minn. This oven was arranged for a manufacturer of free striping automotic reels made of duralium. After the various parts were punched and pressed into shape, they were loaded in a



special nesting tray arrangement as shown by the illustration, and then loaded into the oven. These parts were treated at 925 to 950 deg. F. for 20 min. and then removed.

The uniform heat distribution of the oven and the fast heat transfer made a very high speed production schedule possible and in addition assured maximum uniformity of the duralium parts. The Despatch oven is insulated with 6 in. of rockwool and has been arranged on a flanged leg stand to bring it to proper working level. The nested trays are run to the furnace on a special dolly and pushed into the oven. The oven is electrically heated with a 7-kw heating system and automatically controlled with a Brown mercury filled indicating control. The inside working dimensions are 19 in. wide, 18 in. deep and 24 in. high. The unit can be arranged in any size to meet any heat-treating department requirements.

The fan and heating system are located on top of the furnace. The heated air is forced through a duct down the right side of the furnace to the bottom, then horizontally across the furnace to the left side. The air is then returned to the heating system by a duct on the left side of the oven for reheating and recirculation.

Welding Rod for White Metal

White metal (die casting), which for years was considered as unweldable, is now being satisfactorily welded by employing a new patented process with a special rod, known as "Aladdin Rod," manufactured by the Aladdin Rod & Flux Mfg. Co., P. O. Box 935, Madison Square Station, Grand Rapids, Mich.

This rod, when applied according to instructions, makes a weld that is said to have as great a strength as the base material, and therefore reinforcing is not considered necessary, except where improper design of the object requires an increase of the section at that point.

Many welding shops over the country are new using this new process for the welding of die-casts parts, such as radiator grilles, lamp brackets, carburetor bowls, radiator ornaments, door handles, and other automobile parts, as well as many other die-cast products.

The broken pieces are prepared by grinding off the surfaces to be welded and forming a V at their adjacent edges, then applying the oxyacetylene flame to the side of the V until the metal assumes a liquid appearance, at which times the Aladdin Rod is applied to the prepared edges, at the same time holding the flame parallel with the sides of the V. The plastic end of the weld rod is fed into the groove by touching it to the sides of the V, until the V is completely filled.

YOUNGSTOWN

FOR MAXIMUM PAY-LOAD

HIGH-TENSILE STEEL YOLOY

...ge illustration:- 8½ cu. yd. (7-ton) ...illiams" Breakdown Coal Bucket ...eight 18,000 lbs.) fabricated of ...OLOY steel of 60,000 lbs. yield ...d 90,000 lbs. ultimate strength, by ...e Wellman Engineering Company, ...eveland, Ohio.

...all illustration:- 3 cu. yd. "Williams" ...m-shell bucket (weight 9,100 lbs.) ...r handling zinc ore. In the large ...cket YOLOY was used to ...in INCREASED ...TRENGTH, in the ...aller, to secure ...INIMUM ...EIGHT.

Not only maximum pay-load but also superior resistance to impact and abrasion and 4 to 6 times increased resistance to corrosion are obtained through the use of YOLOY, the nickel-copper steel produced exclusively by YOUNGSTOWN.

The low air-hardening property of YOLOY makes it ideal for welded construction and, in many instances, eliminates the necessity for thermal stress relief. For complete information, write for YOLOY Bulletin.

THE YOUNGSTOWN SHEET AND TUBE COMPANY

Manufacturers of Carbon and Alloy Steels

General Offices - YOUNGSTOWN, OHIO

Sheets; Plates; Tubular Products; Conduit; Tin Plate; Bars; Rods; Wire; Nails; Unions; Tie Plates and Spikes.

YOLOY TRADE MARK YOUNGSTOWN STEEL

YOLOY is available in sheets, strip, bars, plates, shapes, manufacturer's and welding wire, seamless and electric weld pipe.

...A 16-FOOT "BITE"

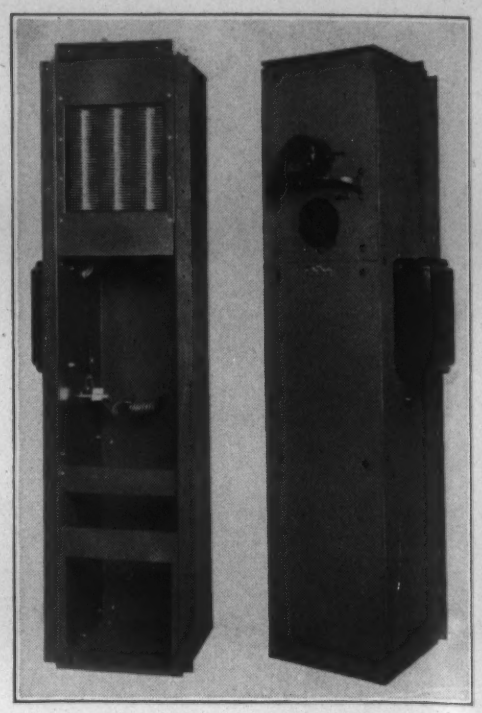
Acme Steel Offers New Tool

An efficient, simply operated shear for cutting flat steel bands has been perfected by the Acme Steel Co., Chicago. This tool is particularly valuable to shippers and receivers who are confronted with the problem of unpacking heavy shipments bound with "Steelstrap." The new shear, recently released, cuts ¾-in. and 1¼-in. bands easily and quickly. Leverage produced by the toggle action of the handles of the shear makes the last portion of the cut as easy as the first.

It has been scientifically designed to prevent fatigue on the part of the operator. And the stationary handle protects the user's hands. A single stroke of the upper handle makes a clean square cut. The two sheared ends of the band remain flat. Curling and uneven edges are eliminated. The "Acme No. 10" shear will not twist or turn. The flat lower jaw of the shear is slid under the taut band holding the cutting edge in a level, even position until the cut is completed.

Electromode Recirculating Dryers

"Electromode Recirculating Dryers," manufactured by the Electric Air Heater Co., division of the American Foundry Equipment Co., 555 Byrkit St., Mishawaka, Ind., proved themselves to be invaluable to many manufacturing and power concerns in inundated sections after the recent flood. In the Electromode Recirculating Dryer, temperatures up to 400 deg. are obtained by means of recirculation. A constant heat within 2 degrees of any desired temperature may be maintained because of the automatic thermostatic control incorporated in the design of the dryer. As these drying units depend entirely on electricity for heating, all cumbersome steam lines and return piping are eliminated.



A housing 6 ft. long by 16 in. deep and 15 in. wide contains all of the heating and circulating mechanism, and may be bolted onto the drying room or chamber. Completely insulated throughout and having no exposed hot wires or glow elements, these dryers are entirely safe from explosions or fires. The elements used are of cast aluminum construction. Heating is accomplished by means of a calrod around which an aluminum gird is poured.

Instrument for Measuring Furnace Atmosphere Quality

The Brown Instrument Co., Philadelphia, announces the development of their "Furnace Atmosphere Analy-Graph." This instrument has been produced after months of elaborate testing to determine the most important measurable factors in furnace atmospheres. The tests covered both electric and fuel-fired furnaces, two widely differing sources of gas feed, and a wide range of temperatures with varying air/gas ratio adjustments.

The recording instrument is of the potentiometer type and is equipped with a 12 in. wide chart graduated so as to render the equipment applicable to measure atmosphere quality whether the said atmosphere results from complete or incomplete combustion, or from dissociation.

The equipment operates on the principle of measuring the thermal conductivity of the gas mixture, which is continuously drawn from the furnace. If the gas is the result of complete combustion, the thermal conductivity will be less than 1.00 due to the presence of CO^2; while if the sample has been produced by incomplete combustion or by dissociation, the thermal conductivity will nearly always be greater than 1.00—the only exception being when there is less than 1 per cent combustible in the final mixture.

In order to render the instrument equally useful for measuring all types of atmospheres, the chart has been divided into two equal sections; one section is used when combustion is complete, while the other is used when combustion is incomplete. This is accomplished by using different electric sensitivities for the Wheatstone bridge through a patented feature.

The Furnace Atmosphere Analy-Graph meets a long felt need in the heat-treating industry, where it is now generally recognized that for best results in preheating, hardening, carburizing, etc., special gas atmosphere must be maintained around the metal. It does away with guess work in establishing the furnace atmosphere and applies potentiometer accuracy to the measurement of furnace atmosphere quality. It is easily maintained—independent of normal variations in furnace pressure, room temperature, and atmosphere humidity. The large scale on the instrument permits operators to continually observe the condition of their furnace atmosphere even at a distance.

FOUR OF A KIND AND ALL "TOPS"

FIRTHITE
FIRTHITE
Sintered Carbide
for
MAXIMUM PRODUCTION
through fast clean cutting and long tool life.

CIRCLE ©
CIRCLE C
Super
High Speed Steel
for
MAXIMUM PRODUCTION
where a steel is used in preference to Tungsten Carbide.

FIRTHALOY
FIRTHALOY
Sintered Carbide
for
MAXIMUM PRODUCTION
in cold drawing, wire forming, extruding and sizing.

CROMOVAN
CROMOVAN
Triple Die Steel
for
MAXIMUM PRODUCTION
or blanking, forming, pressing, thread rolling, etc.

HIGH PRODUCTION PRODUCTS

These four products make possible surprising production on modern machine tools and add greatly to the productive value of old machines. Each has been used for years in outstandingly efficient plants. Each has proven a profit maker where a large volume—often measured in millions of pieces—must be handled rapidly.

From our broad line of materials for complete shop tooling these four are the choice of the most discriminating engineers or shop executives.

A trial will prove these values to you

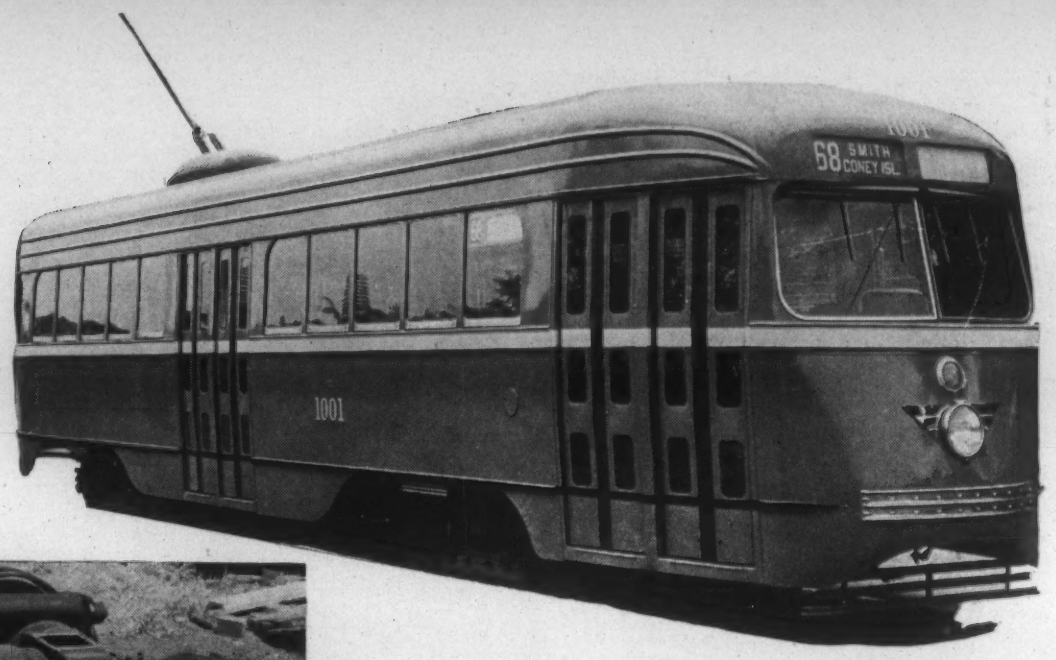
FIRTH-STERLING STEEL COMPANY

Works McKEESPORT, PA
NEW YORK CHICAGO
HARTFORD CLEVELAND
DETROIT LOS ANGELES
PHILADELPHIA DAYTON
GLOBE WIRE DIVISION
McKEESPORT, PA

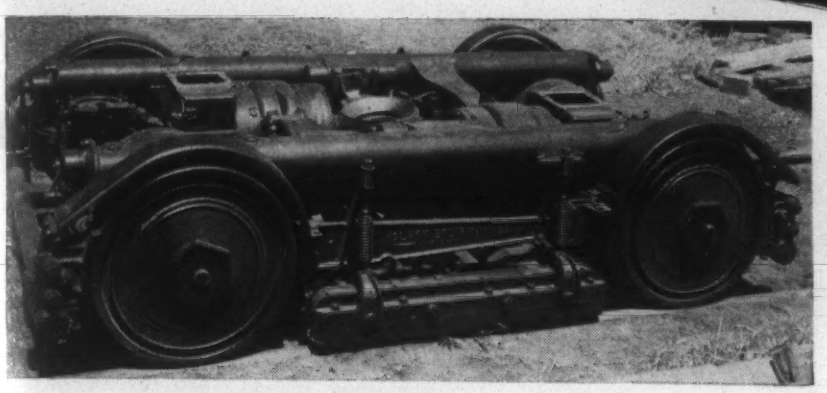
MA 250

You, too, can save weight on your equipment

. . . use VANADIUM STEEL



Vanadium Steels contibute to the speed and riding comfort of the modern trolley cars recently placed in service in Brooklyn and Chicago.



Vanadium Steel Castings and Carbon-Vanadium Steel axles aided the designers to reduce the weight of these trolley car trucks.

Now trolley cars, like high speed Diesel trains, streamlined steam trains, buses and trucks, are eliminating needless weight with castings and forgings of Vanadium Steel.

In Brooklyn's and Chicago's new trolley cars, tubular side frames, cross-member castings and bolsters are Vanadium Cast Steel. So are the weight-saving castings which house the rubber springs. Axles of Carbon-Vanadium Steel and Vanadium Steel in transmission hubs, transmission housings and other parts have helped the designers to eliminate much needless weight. The entire trolley, with maximum passenger load, weighs only 31,000 pounds.

In transportation units of every type, Vanadium Steel Castings, Vanadium Steel Forgings and Manganese-Vanadium Steel Plates and Shapes will help you to eliminate dead weight and increase payload. Metallurgical Engineers of the Vanadium Corporation of America will be glad to discuss specific problems—without obligation to you.

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VANADIUM CORPORATION OF AMERICA
420 LEXINGTON AVENUE, NEW YORK, N. Y.
Plants at Bridgeville, Pa., and Niagara Falls, N. Y.
Research and Development Laboratories at Bridgeville, Pa.

Vanadium Steels

METALS VANCORAM ALLOYS

FERRO ALLOYS
of vanadium, silicon, chromium, and titanium, produced by the Vanadium Corporation of America, are used by steel makers in the production of high-quality steels.

FOR STRENGTH · TOUGHNESS · DURABILITY

TWO NEW BOOKLETS

To Help You Increase the Efficiency of Your Heated Equipment

YOU'LL find valuable facts and figures on how to make heated equipment more efficient and productive, in these informative new booklets on Armstrong's High Temperature Insulation.

"Armstrong's Insulating Fire Brick for All Types of Heated Equipment" describes in detail the many advantages of Armstrong's Light-Duty and Heavy-Duty Insulating Fire Brick for all types of heated equipment. The size, weight, crushing strength, and complete technical specifications of each brick are fully covered in the pages of this booklet. In addition, special shapes and sizes are illustrated and described.

To assure satisfactory installation of Armstrong's Insulating Fire Brick, Armstrong manufactures a complete line of insulating cements and coatings which are described in the second booklet, "Armstrong's Cements for Laying and Facing Insulating Fire Brick."

The Armstrong's Insulating Fire Brick and Insulating Cements, described in these booklets, are specified today by leading furnace manufacturers and plant engineers because experience has demonstrated the consistent and dependable performance of these materials. Engineers or plant owners concerned with the manufacture or operation of furnaces, boilers, incinerators, or other types of heated equipment, are invited to mail the coupon now for their free copies of "Armstrong's Insulating Fire Brick" and "Armstrong's Cements for Laying and Facing." Armstrong Cork Products Company, Building Materials Division, 982 Concord Street, Lancaster, Penna.

Armstrong's

HIGH TEMPERATURE INSULATION

ARMSTRONG CORK PRODUCTS COMPANY
Building Materials Division, 982 Concord St.
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MA 252

"Xaloy" for Resistance to Abrasion

Manufacturers and users of equipment, in which abrasive wear is a problem or extreme surface hardness is desirable, will be interested in Xaloy which has several unusual metallurgical properties. Although this alloy has been used in oil well equipment for some time with remarkable success (under the name of "I. R. Metal") it is now being made available to a broader field through the Wilcox-Rich Division of Eaton Mfg. Co., Detroit, under license from Industrial Research Laboratories, Ltd.

"Xaloy" is most suitable where its high hardness and unusual resistance to abrasion can be used to advantage and where high impact values and ductility are not important. It has a tensile strength of 43,000 lbs. and compression strength of 240,000 lbs. per sq. in. Its coefficient of thermal expansion is 7.2 x 10^{-6} per in. per deg. F. and its thermal conductivity is 7.5 B.t.u. per hr. per sq. ft. per deg. F. Its hardness is equivalent to 750 Brinell or 68 to 70 Rockwell C scale.

A unique method of centrifugal casting has been perfected by Wilcox-Rich at its Battle Creek, Mich., plant. Xaloy is applied in a molten state to the outside or inside diameters of bushings or other tubular pieces subjected to abrasive wear. A perfect fusion bond is obtained. The coating of Xaloy has absolutely uniform surface hardness and uniform thickness. Due to the extreme hardness and abrasion resistance of this metal, the thickness of the wall is controlled very closely to reduce to a minimum the finishing operation for which special honing and grinding equipment is required. The resulting surface is mirror-like with an extremely low coefficient of friction.

Application of the metal to irregular surfaces is accomplished by means of casting in permanent or sand mold or by the use of inserts faced with Xaloy. Narrow flat surfaces or edges are coated with Xaloy by the centrifugal-casting method; however, sizes are at present somewhat restricted. The expense of shut-downs and the frequency of replacements are greatly reduced by the application of an Xaloy lining or coating to bushings or rollers on equipment subjected to the abrasive wear of materials.

In ascertaining the usefulness of Xaloy in the general industrial field, the manufacturer has met with success in a variety of applications. For instance, it was found that the life of tool bushings is lengthened 500 to 600 per cent. Exceptional results were also obtained by the use of Xaloy as an internal liner for honing control-bushings which have a continuous wiping-wear on the inside diameter aggravated by the presence of abrasive compound. Lining briquetting molds with this metal increased their life 400 to 500 per cent. This is one of the severest tests yet undergone by Xaloy inasmuch as cast iron turnings and borings are compressed into these cylindrical molds under a 300-ton pressure, presenting an extremely difficult wear problem.

Xaloy material has proved itself valuable in cylinder liner installations. Its high hardness and resistance to abrasion enable it to give longer life in those internal combustion engine installations where duty is extremely severe or where dusy surroundings cause rapid wear of softer cylinder liners.

Cementing Material

A new cementing material resembling the natural mineral, atacamite, promises wide usefulness to the building arts, Dean S. Hubbell of the Mellon Institute of Industrial Research, Pittsburgh, reports in *Industrial and Engineering Chemistry*, publication of the American Chemical Society. Suitable as the cementing constituent in composition floors, stucco, tiles, and many other building parts, the new inorganic adhesive consists of magnesium oxychloride cements to which 10 per cent of finely divided copper powder has been added. Unusual properties result from combining the cement and metal. Strength and resistance to abrasion is greatly increased, damage by water prevented, harmful expansion eliminated, and surface changes reduced. The adhesive makes a permanent bond with Portland cements.

MANUFACTURERS' LITERATURE

Cor-Ten and Man-Ten

Pamphlet describing high-tensile steels developed to meet the needs of the transportation industry. United States Steel Corp., Pittsburgh, Pa. (B 461)

Speed Case Steels

Data on the three new types of this company's "Speed Case" steel in the higher carbon ranges are offered by The Monarch Steel Co., Indianapolis, Ind. (B 462)

Silico-Manganese Spring Steel

Extreme care is taken in processing this steel to avoid imperfections, according to the manufacturer. Illustrated. Bethlehem Steel, Bethlehem, Pa. (B 463)

A New Motorblower

Type CS Motorblower was designed to meet the needs of the services requiring air at one-pound pressure in volumes from 325 to 3200 cu. ft. per min. Ingersoll-Rand, New York, N. Y. (B 464)

Everdur

This metal is a high strength, non-magnetic, non-sparking alloy of the solid solution type composed of copper, silicon and other controlled elements, according to this illustrated leaflet. American Brass Co., Waterbury, Conn. (B 465)

Micromax Recorder

A paper model of this recorder shows each unit, inside and out, in true perspective, with chart and record in color. Die-Out ND (1). Leeds & Northrup, Philadelphia, Pa. (B 466)

Car Hearth Furnaces

Bulletin C-736 is devoted to these furnaces which were designed for uniform heating, sturdy construction and fuel economy. The Philadelphia Drying Machinery Co., Philadelphia, Pa. (B 467)

Fire Brick

This company's Empire fire brick is the subject of a booklet in which the three types—dry press, stiff mud and hand-made—are described. A. P. Green Fire Brick Co., Mexico, Mo. (B 468)

Vanadium Steels

Various of these steels for locomotive and car construction are described in a booklet which also gives the complete specifications for each steel. Vanadium Corp. of America, New York, N. Y. (B 469)

Nitralloy and Nitricastiron

Leaflet describing three groups of Nitralloy. It also discusses the special alloy steels classified as "Nitrard" and "Nitricastiron," their nitrided cast iron. The Nitralloy Corp., New York, N. Y. (B 470)

Multi-Rotary Table

The Wheelabrator multi-rotary table—the airless abrasive method of cleaning fragile or intricate metal parts—is described in Folder No. 33. The American Foundry Equipment Co., Mishawaka, Ind. (B 471)

Herculoy

A new 60-page bulletin containing data on this silicon bronze alloy which, according to the manufacturer, possesses the strength of steel and corrosion resistance of copper, has been issued by the Revere Copper and Brass, Inc., New York, N. Y. (B 472)

Manganese Steel Products

Bulletin R-1 which contains the statement that this company's rolled manganese steel follows precisely the "Hadfield Formula" also contains an alphabetic list of applications. Manganese Steel Forge Co., Philadelphia, Pa. (B 473)

Fire Clay Products

A folder contains brief descriptions of the Goose Lake Products and Therm-O-Flake (for high temperature insulation) products. Illinois Clay Products Co., Joliet, Ill. (B 474)

Free Cutting Steel

An attractive booklet records fifteen years spent by the company's metallurgical department in research on the machinability of free cutting steels. Jones & Laughlin Steel Corp., Pittsburgh, Pa. (B 475)

Electric Heating Elements

A bulletin from this company is devoted to their electric heating elements and terminal accessories for industrial applications. Globar Div., Carborundum Co., Niagara Falls, N. Y. (B 476)

Special Atmosphere in the Heat Treatment and Brazing of Metals

A reprint of the above article by C. L. West, Research Engineer, is offered by The Electric Furnace Co., Salem, O. (B 477)

Armco H.T.-50

An illustrated folder devoted to the above alloy steel contains data on the average physical properties, corrosion resistance and forming and welding qualities. American Rolling Mill Co., Middletown, O. (B 478)

Temperature Control

An all electric automatic control which operates on the radio principle is described in an illustrated leaflet. Wheelco Instruments Co., Chicago, Ill. (B 479)

Spectrometric Equipment

Catalog D-221 is devoted to the above equipment. Basic theory and designs are described as well as the various types of instruments. Illustrated. Bausch & Lomb Optical Co., Rochester, N. Y. (B 480)

Colmonoy

Bulletin No. 50 is devoted to the wear-resistant, corrosion-resistant and heat-resistant alloys and overlay metals of the Colmonoy Co., Los Nietos, Calif. (B 481)

What Scientists Say of Leitz Ultropak

Bulletin No. 17 describes the personal experiences and applications to which Ultropak has been placed by scientific workers in various fields. E. Leitz, Inc., New York, N. Y. (B 482)

Rapid Moore Lectromelt Furnaces

Bulletin No. TC describes patented lift and swing-aside-roof type quick top-charge electric melting and refining furnaces. Pittsburgh Lectromelt Furnace Corp., Pittsburgh, Pa. (B 483)

The Jetal Process

Simple immersion in an aqueous bath for about 5 minutes colors all grades of common iron or steel a brilliant and uniform jet black. It is claimed it does not alter dimensions or articles and cannot chip, scale, peel or discolor. Alrose Chemical Co., Providence, R. I. (B 484)

Dipping Baskets

If none of the 14 standard designs meets the customer's approval, this company will manufacture baskets to specifications. C. O. Jelliff Mfg. Corp., Southport, Conn. (B 485)

Ring Type Proving Instruments

These instruments for checking materials testing machines are pictured in a leaflet which states that they are made in eleven capacities—compression only and compression and tension both. Morehouse Machine Co., York, Pa. (B 486)

Heat and Corrosion Resistant Alloys Heated By Gas

Bulletin C1-A illustrates a number of complex castings made from Q-Alloys which are recommended for pipe fittings, furnace parts, etc. General Alloys Co., South Boston, Mass. (B 487)

Beryllium Copper

Data on properties, heat treatment and fabrication of this copper alloy are given in an illustrated leaflet of The Beryllium Corp. of Penn., Reading, Pa. (B 488)

Zinc Alloy Die Castings

This supplement of "A Visual Report of Progress" brings the progress being made in the die casting industry up to date. The New Jersey Zinc Co., New York, N. Y. (B 489)

Stainless Steel Castings

An attractive booklet contains useful information on the subject. Typical analyses, characteristics and suggested uses are listed. Joseph T. Ryerson & Son, Inc., Chicago, Ill. (B 490)

Value of Draft Control

Bulletin No. L-125 is devoted to the above and points out the value of this company's control which consists of a draft switch, a damper motor and a manual station. Illustrated. Shallcross Controls, Inc., Milwaukee, Wis. (B 491)

Yoloy

A colorful bulletin summarizes the properties of the above alloy steel and lists the physical properties of two typical steels in the Yoloy series. Youngstown Sheet and Tube Co., Youngstown, O. (B 492)

Fluxing, Deoxidizing and Hardening Alloys

Ajax alloys (phosphor, copper, phosphor tin, nickel copper, manganese copper and silicon copper) are the subjects of a new leaflet issued by the Ajax Metal Co., Philadelphia, Pa. (B 493)

Nickel Silver

New 48-page booklet, 8½ x 11 inches, describing this product as manufactured in sheets, strip, wire and rods, and profusely illustrated with the industrial applications of the product. The Riverside Metal Co., Burlington County, Riverside, N. J. (B 494)

MANUFACTURERS' LITERATURE

Combustion Equipment

Proportioning valves for gas-air and oil-air, gas burners, oil burners and other equipment for industrial fuel burning are illustrated in a leaflet of the North American Mfg. Co., Cleveland, O. (B 495)

Adahearth

It is claimed that only the highest grade South African chrome ore is used as the base material in this chemically neutral refractory. Botfield Refractories Co., Philadelphia, Pa. (B 496)

Electro-Granodizing

This process which, according to the manufacturers, provides a rust-proof, paint-receptive surface is described in an illustrated leaflet of the American Chemical Paint Co., Ambler, Pa. (B 497)

Modern Metal Finishing

This bulletin is issued periodically. Besides brief articles, a Questions and Answers department is conducted as a special service for metal treaters. E. I. du Pont de Nemours & Co., Inc., Wilmington, Del. (B 498)

Alloy Castings

Corrosion-resistant and stainless steel castings are the subject of a new booklet. Michiana Products Corp., Michigan City, Ind. (B 499)

Monel Metal

Many of the industrial uses of this alloy are discussed in a catalog entitled "Strength Plus—Monel for Mechanical Jobs." The International Nickel Co., Inc., New York, N. Y. (B 500)

Properties of OFHC Copper

An attractive booklet contains reprints of three papers relating to the above subject. United States Metals Refining Co., New York, N. Y. (B 501)

3300 Deg. Super Refractory

An illustrated catalog devoted to "Shamva" Mullite contains information regarding its background, characteristics and uses. Mullite Refractories Co., Shelton, Conn. (B 502)

Liquitol

Bulletin A1-16-A deals with the use of Liquitol for iron and steel castings and ingots. Alpha-Lux Co., Inc., New York, N. Y. (B 503)

Stainless and Heat Resisting Electrodes

A colorful price list and data book containing complete descriptions of the company's products and also analyses of stainless and heat resisting alloys manufactured by other companies has been issued by Maurath, Inc., Cleveland, O. (B 504)

Positive Displacement Blowers

Bulletin 22-B12 discusses the structural features of these blowers. Roots-Connersville Blower Corp., Connersville, Ind. (B 505)

Alloy Steels

A colorful folder devoted to these steels lists some of the advantages to be obtained by their use. Bliss & Laughlin, Inc., Harvey, Ill. (B 506)

Air Conditioning Lectrodryer

This equipment is designed for dehumidification and not for temperature control. Pittsburgh Lectrodryer Corp., Pittsburgh, Pa. (B 507)

A. W. 70-90

This bulletin describes the new high-strength "70-90" steel in sheets and plates. Alan Wood Steel Co., Conshohocken, Pa. (B 508)

Ferrocarbo

This material containing both silicon and carbon combined in the form of silicon carbide acts as a graphitizer or softener when added to cast iron. Carborundum Co., Niagara Falls, N. Y. (B 509)

Rocking Furnace

Type G-M is a small-scale indirect arc electric furnace designed for iron, steel, brass, copper and nickel alloy. Detroit Electric Furnace Co., Detroit, Mich. (B 510)

Combustion Tube Furnaces

Tube furnaces, made in two types—hinged and solid—are described and illustrated in Bulletin HD 1236. Hevi Duty Electric Co., Milwaukee, Wis. (B 511)

Gasifier

A pamphlet devoted to the Stewart gasifier contains the claims that its use reduces fuel costs as much as 75 per cent, produces a true gas of high B.t.u. value and is easier on furnace lining. Chicago Flexible Shaft Co., Chicago, Ill. (B 512)

Improved Pot Hardening Furnaces

A leaflet devoted to these furnaces which have an insulating refractory lining backed by block insulation, heat-resisting alloy burners and single valve control, has been issued by the American Gas Furnace Co., Elizabeth, N. J. (B 513)

TAM Products

Leaflet descriptive of TAM metallurgical alloys. The Titanium Alloy Mfg. Co., Niagara Falls, N. Y. (B 514)

Steel Castings

A number of the more popular carbon, alloy and stainless steels made by this company are discussed in a leaflet. Lebanon Steel Foundry, Lebanon, Pa. (B 515)

Aerocase

Booklet on this subject. Illustrations, curve charts, tables. American Cyanamid and Chemical Corp., New York, N. Y. (B 516)

Control of Furnace Atmosphere

Two new bulletins—No. 11—devoted to an illustrated description of "Certain Curtain control of atmosphere" and No. 103—devoted to furnaces for pre-heating and hardening high-speed steel—have been issued by C. I. Hayes, Inc., Providence, R. I. (B 517)

Konik

Data on this steel's physical properties, corrosion resistance and working are offered by the Continental Steel Corp., Kokomo, Ind. (B 518)

Electric Air Tempering Furnace

Comparative costs in operation of the new air tempering furnace and the old salt bath show a distinct saving by the use of the new furnace, as well as improvement in quality and uniformity, according to Leaflet 36A of the American Electric Furnace Co., Boston, Mass. (B 519)

Control System

Bulletin No. 460T describes a coordinated control system for automatically operating all the technical operations and factors of an industrial process. The Bristol Co., Waterbury, Conn. (B 520)

Surface Hardening by Induction

The TOCCO Process which, it is claimed, reduces hours of surface-hardening time to seconds and produces a scientifically regulated, exact result, is discussed in an illustrated leaflet of The Ohio Crankshaft Co., Cleveland, O. (B 521)

Drop Forging Topics

Interesting articles are included in this illustrated publication of the Drop Forging Association, Cleveland, O. (B 522)

Cataloy Lead Bronze

This process which is guaranteed to perfectly combine copper and lead in your own plant is described in literature from Cataloy, Los Angeles, Cal. (B 523)

Heavy Duty Refractories

This handbook contains complete descriptions, applications, tables and illustrations of standard shapes. Many useful engineering data are included. Norton Company, Worcester, Mass. (B 524)

Ampco Metal

Engineering data of a general nature are offered in Catalog No. 21. Technical explanations have been written so that the layman may understand them. Ampco Metal, Inc., Milwaukee, Wis. (B 525)

Furnaces

Information concerning Hausfeld modern melting equipment for die casting is featured in an illustrated leaflet. Campbell-Hausfeld Co., Harrison, O. (B 526)

Heat and Acid Resisting Castings

Bulletin No. 21 lists the most popular analyses of Standard-Alloy together with safe workable loads at different temperatures. The Standard Alloy Co., Cleveland, O. (B 527)

Midvaloy No. 77

An unusual oil hardening alloy steel for use in ball races, balls and bearings, taps and tapper taps, etc., is described in a leaflet of The Midvale Co., Nicetown, Philadelphia, Pa. (B 528)

Duraloy

Chrome-nickel and chrome-iron alloy groups with recommended applications are listed in a new pamphlet from this company. Illustrated. Duraloy Company, Pittsburgh, Pa. (B 529)

MANUFACTURERS' LITERATURE

Testing Machines

Catalog 50, Part L, features Olsen Universal testing machines. Complete descriptions and illustrations. Tinius Olsen Testing Machine Co., Philadelphia, Pa. (B 530)

Sixteen Sins of the Cleaning Room

Are listed in a circular for convenience in checking on cleaning rooms. Great Lakes Foundry Sand Co., Detroit, Mich. (B 531)

Chapmanizing

A pamphlet devoted to Chapmanizing which is a process of hardening low-carbon steel, compares it to nitriding and carburizing. The Chapman Valve Mfg. Co., Indian Orchard, Mass. (B 532)

High Temperature Insulation

For all types of heated equipment is the subject of an illustrated leaflet issued by Armstrong Cork Products Co., Lancaster, Pa. (B 533)

Sonittep Products

This booklet discusses heat loss and its control. The advantages of Sonittep insulating cement and its uses are listed. George F. Pettinos, Inc., Philadelphia, Pa. (B 534)

The Metal Analyst

Equipment for metallurgical laboratories is described and illustrated in a booklet of Adolph I. Buehler, Chicago, Ill. (B 535)

Electric Furnace

The Sentry Model "Y" which is described in Bulletin 1019 is offered especially for small tools, whether hardened on a production or intermittent basis. The Sentry Co., Foxboro, Mass. (B 536)

Wet Patch

The manufacturer claims that excellent results are obtained when P. B. Sillimanite wet patch is used to patch crucible furnaces, electric furnaces, etc. The Chas. Taylor Sons Co., Cincinnati, O. (B 537)

Quenching Machine

In the Greene tank objects are forced apart and kept in motion, solution vigorously sweeps over the objects and cooling is equal on all sides according to a leaflet of E. G. Greene, Cleveland, O. (B 538)

Finish Baking and Drying Ovens

Ovens for various finishing processes are featured in two new bulletins, pages 101-104 Section A-5, which have been issued by the Despatch Oven Co., Minneapolis, Minn. (B 539)

Repeated Stress Machines

These machines for determining the endurance limits of bar, wire and sheet metals are described in a pamphlet of G. N. Krouse, New Kensington, Pa. (B 540)

Molybdenum in Steel

Data on different types of molybdenum steels are given in an illustrated booklet of the Climax Molybdenum Co., New York, N. Y. (B 541)

Controlled Grain Anodes

Seymour Nickel Anodes are homogeneous in grain structure, according to this bulletin. Available shapes are illustrated and useful data are given. The Seymour Manufacturing Co., Seymour, Conn. (B 542)

Chain and Belt Conveyors

Bulletin 1-B discusses conveyors for use at high temperature. Michigan Steel Casting Co., Detroit, Mich. (B 543)

Berwick Electric Metal Heaters

Among the advantages claimed for electrically heating steel are: there are no impurities in electricity to affect the steel; the current passes equally through all portions of the steel at the same time so that the core receives the same degree of heat as the outer circumference and the only loss is by radiation. American Car and Foundry Co., New York, N. Y. (B 544)

Bimetal

A simplified version of its manufacture and the way it works is contained in this pamphlet. W. M. Chace Co., Detroit, Mich. (B 545)

The Brackelsberg Furnace

Bulletin No. 197 is devoted to the above subject. How this furnace lowers the cost of quality castings, other important advantages and design and operation are discussed. Whiting Corp, Harvey, Ill. (B 546)

Turbo-Compressor Data Book

This Data Book No. 107 was prepared to give accurate and brief information on the engineering characteristics of turbo blowers and exhausters. The Spencer Turbine Co., Hartford, Conn. (B 547)

Braze-Rite Furnace

This furnace, developed principally for brazing sintered carbide cutting tools, provides for localized heat to be applied only to the portion of the tool to be brazed. Firth-Sterling Steel Co., McKeesport, Pa. (B 548)

High Frequency Electric Power Converters

According to illustrated pamphlets, this company manufactures high frequency electric converters for use in conjunction with numerous industrial induction heating applications. Lepel High Frequency Laboratories, Inc., New York, N. Y. (B 549)

Zinc Plating

Zin-O-Lyte, a process for bright zinc plating producing brilliant deposits direct from the bath without bright dipping, is the subject of a new bulletin of the Grasselli Chemicals Dept. of E. I. du Pont de Nemours & Co., Cleveland, O. (B 550)

Corrosion and Heat Resisting Stainless Steels

This company claims that its materials are manufactured by special processes involving direct reduction of chrome ore and providing a closer metallurgical control than has been obtainable heretofore. Rustless Iron and Steel Corp., Baltimore, Md. (B 551)

Silicon-Chromium-Molybdenum Steels

A booklet devoted to Sicromo 1, 2, 3 and 5 steels, gives the analyses of the steels and discusses the effect of both silicon and chromium on the oxidation resistance of steels in which they are used. The Timken Steel & Tube Co., Canton, Ohio. (B 552)

Alloy Steel Castings

Information on corrosion resistance and technical data on Durimet are included in a bulletin of The Duriron Co., Inc., Dayton, O. (B 553)

Research Microscopes

Microscopes and their accessories are discussed in Catalog M66. Spencer Lens Co., Buffalo, N. Y. (B 554)

Extensometer

The Kenyon-Burns Young extensometer is described and illustrated in Bulletin 128. Baldwin-Southwark Corp., Philadelphia, Pa. (B 555)

Gas Analysis

Bulletin describing the thermal conductivity method of gas analysis is published by Charles Engelhard, Inc., Newark, N. J. (B 556)

Superficial Hardness Tester

Catalog Supplement RS-3 is devoted to this hardness tester, intended exclusively for hardness tests where only very shallow penetration is possible and it is desired to know the hardness of the specimen close to the surface. Wilson Mechanical Instrument Co., New York, N. Y. (B 557)

Die Block Hand Book

A compact booklet containing quite complete data on die blocks, with an index included, has been issued by the Heppenstall Co., Pittsburgh, Pa. (B 558)

Calite Alloy Pots and Carburizing Boxes

Circular "PB" is devoted to the above. Illustrated. The Calorizing Co., Pittsburgh, Pa. (B 559)

Case Hardening

General information regarding "Kasenit" case hardening compounds is contained in a pamphlet of the Kasenit Co., New York, N. Y. (B 560)

Welding and Cutting Apparatus

A profusely illustrated catalog is devoted to the apparatus of the Victor Equipment Co., San Francisco, Cal. (B 561)

Checker Brick for Regenerative Furnaces

When laid, the "Superior" checker bricks are automatically locked in place producing, according to the manufacturer, a solid stable checker volume and absolutely straight flues. Wm. M. Bailey Co., Pittsburgh, Pa. (B 562)

Transformers for Metallurgical Furnaces

Bulletin 330 lists some of the improvements which contribute to the successful operation of this company's furnace transformers. Pennsylvania Transformer Co., Pittsburgh, Pa. (B 563)

Book Reviews

ELECTRON THEORY OF METALS. *(Elektronentheorie der Metalle)*

Herbert Frohlich.

Julius Springer, Berlin, 1936, 386 pages, 71 illustrations. Price 28.8 RM. (Vol. XVIII of Monographs on "Structure and Characteristics of Matter" edited by F. Hund and H. Mark).

Theoretical physicists have made great strides in the last 10 yrs. in building up a successful theory of metals. The fundamental characteristics of the metallic state are nearly all explained qualitatively in terms of quantum mechanics or wave mechanics and rapid progress is now being made with quantitative calculations of lattice constants, compressibilities and elastic constants, binding energies, conductivities and certain of the crystal structures of alloys. This book explains the theoretical developments and compares them with experimental data. The subjects covered include: the Schrödinger equation and its solutions; the electron in the periodic potential; electron emission; reflection of electrons; optical properties; the photoelectric effect; X-ray emission and absorption effects; magnetism; electrical and thermal conductivity; thermal vibrations and thermoelectric effect; the Hall effect; semi-conductors; metallic binding metals in relation to the periodic table. In the appendix are explanations of Fermi statistics, Bose-Einstein statistics, lattice potential, and alloys with the gamma structure. There are 224 references.

While the author has endeavored to minimize the mathematical ability required of his readers, it should be remembered that he is writing for those familiar with advanced physics and has not hesitated to use vector analysis, complex variables, and partial differential equations—all of which, of course, are necessary in any treatment of this subject that pretends to be anything but superficial.

The book is to German readers what Mott and Jones' "The Theory of the Properties of Metals and Alloys" (Clarendon Press, Oxford, 1936) is to English readers, except that the Frölich treatise gives less attention to the relation of Brillouin zones to crystal structure and more attention to optical properties, thermionic emission, and work functions than does the Mott-Jones treatise.—C. S. BARRETT.

THE STEEL PHYSICAL PROPERTY ATLAS. Charles Newman Dawe.

The American Society for Metals, Cleveland, 1936. Cloth, 8½ x 11 in., 87 pages, 35 charts in color. Price $2.50.

This is a collection of charts showing the effect of heat treatment on the mechanical properties of common steels. It should be of value to those who want to know approximately what to expect. To be of greater value such charts should be the outcome of a statistical treatment of the properties of a number of specimens from many heats, and even so can be expected to do no more than serve as a guide; quite different results in specific cases are to be expected.

The present work would be improved by the inclusion of information concerning the number of tests and the scatter in results, following, for instance, the recommendations of the A.S.T.M. in this respect. The colored ink in the graphs has been wasted; the yellow used throughout for the elongation curves is quite difficult to read. The task of improving upon this book is a truly formidable one, not to be undertaken by an individual, but a project worthy of the support of our national societies.—M. GENSAMER.

EXAMINATION OF MATERIALS WITH X-RAYS. *(Materialprüfung mit Röntgenstrahlen)* 2ND EDITION.

R. Glocker.

Julius Springer, Berlin, 1936. Cloth, 6¼ x 9¼ in., 386 pages, 315 illustrations. Price 33 RM.

The first edition of this book, which appeared in 1927, became one of the standard texts on applied X-rays, and was held in high esteem for its sound, well-illustrated explanation of equipment, methods, and results. It was written shortly after there had been great advances made in the field, particularly in the study of metals. It has now been extensively revised and the new edition merits the same hearty approval that the first earned. There have not been fundamental X-ray developments in the last ten years, however, to compare in scope and importance with those of the preceding ten, so the book has not been greatly expanded. A section has been added on the X-ray determination of elastic stresses, and this is a very timely one for important advances have been made in this work recently, several of them by Glocker himself. The measurement of uniaxial and biaxial stresses both with and without calibration exposures on unstressed samples is explained at length. Other added material includes back-reflection cameras, X-ray gonimeters of the Weissenberg-Böhm, Schiebold-Sauter types, an expanded table of crystal structures, including a table of alloy structures (129 alloy systems) that was prepared by U. Dehlinger, stereographic projection, superlattices, transformations and transitional structures, gamma-ray radiography, and revised tables of preferred orientations in metals.

The author has added this material and rewritten much of the rest of the book without adding appreciably to its length, for he has cut out considerable material that is now of lesser importance. He had the good judgment, for example, to delete eight pages of the first edition containing the description of his own method of determining preferred orientations in metals, which is not being used in late years. In the chapter on chemical analysis by X-rays, he has deleted a ten-page table of spectral lines that coincide with each other in wave length.

The book treats X-ray apparatus, properties of X-rays, radiography, chemical analysis by X-rays, fundamentals of crystallography, X-ray methods of crystal structure determination, the crystal structures of chemical compounds and alloys, widening of diffraction lines, measurement of elastic stresses, preferred orientations in metals, and in the appendix, gnomonic and stereographic projection, the reciprocal lattice, and various crystallographic formulae.—C. S. BARRETT.

ATLAS METALLOGRAPHICUS (Cast Iron).

H. Hanemann & A. Schrader.

Vol. II, Section I. Gray Iron, parts 1-4. Gebrüder Borntraeger, Berlin, 1936. Paper, 7½ x 10¾ in., tables 1-32. Price 30 RM.

This new part of the Atlas contains 229 of Miss Schrader's beautifully executed micrographs of cast iron, with data on composition, size of casting, tensile strength, hardness, etc. for each specimen studied. The various systems met in cast iron are briefly discussed from the equilibrium diagram point of view in the introduction, together with methods for polishing and etching.

So many of the possible structures in cast iron are illustrated that, if everyone had the Atlas at hand, one could save himself the trouble of making many micrographs and simply define them, after visual examination, as similar to particular plates in the Atlas. The composition of the specimens is given even down to the few hundredths of a percent of Cu, Ni, Cr, and Ti. Many other details are given attention, e.g. the structure of graphite flakes under polarized light and the form of titanium nitride and carbide inclusions.

The Atlas is still in loose leaf form, so that one has to be careful not to lose or misplace any of the sheets. They are too valuable to lose. Everyone interested in the metallography of cast iron will appreciate having this monumental work.—H. W. GILLETT.

TUNGSTEN. METALLURGY, PROPERTIES, APPLICATIONS. 2ND EDITION.

C. J. Smithells.

D. Van Nostrand Co., Inc., New York, 1936. Cloth, 6¼ x 9¼ in., 272 pages. Price $8.00.

Smithells, who is with the British G. E. Co., covers the field of W wire, but has called upon Monypenny for the chapter on iron tungsten alloys, on Reimann for that on thermionic emission and on Bird for that on hard alloys.

The chemistry of the purification of WO_3 and of its reduction by hydrogen or carbon, the sintering, swaging and wire-drawing processes are described. Metallographic technique, grain size control by addition of thoria and the production of single crystals, including deposition from the gaseous chlorine compounds are dealt with. The effects of cold work and of annealing are illustrated by micrographs and X-ray patterns. Electrical and mechanical properties, including optical properties at high temperature, of interest in optical pyrometry, and data on thermionic emission useful in vacuum tube work are dealt with at considerable length.

High-speed steel, stellite, magnet steel and precipitation-hardening iron-tungsten and iron-cobalt-tungsten are given a short chapter. In another tungsten-molybdenum, nickel-tungsten, tungsten-cobalt, and lead-tungsten alloys, and copper-tungsten mixtures are briefly discussed, and tungsten-rhenium and tungsten-tantalum alloys mentioned.

The well known uses of metallic tungsten are briefly stated and very general comment on sintered carbide tools and dies given, but welded overlays are not mentioned. The final chapter deals with chemical and spectrographic analysis for impurities.

It is a convenience to have authoritative data collected in one volume, and to the specialist in tungsten wire it will be of prime interest. The general metallurgist can, however, find out what is here given on tungsten alloys from other sources. Indeed, he must seek other sources when he wants more than the barest outline on such topics as high speed steel. Nor is it easy to find the other literature through the references, for relatively few are given. It's a rather good book but the price is about twice what it should be in comparison with usual prices for monographs of the type by American authors. This may be because it was printed in England.—H. W. GILLETT.

MACHINABILITY OF MATERIALS

(Die Zerspanbarkeit der Werkstoffe)

WERKSTATTBUECHER NO. 61

K. Krekeler.

Julius Springer, Verlag, Berlin, 1936. Paper, 6x9 in., 60 pages. Price 2 RM.

Written primarily from the point of view of the mechanical engineer. Comparisons as to machinability are made, for a given feed, on the basis of speed to give a tool life of 60 min. in rough turning. Taking the performance of high speed steel of 0.6-0.9% C, 18-20% W, 2.0-1.2% V, 2-3% Co as standard, 14.18% W, 0.2-0.8% V, 0% Co is calculated to allow only 75 per cent of the speed while 0.6-0.85% C, 17-20% W, 1.0-1.6% V, 0-1% Mo, 16-20% Co allows 120% and the W carbide tools 400 to 800 per cent. The absence of chromium from the high speed compositions mentioned is noteworthy.

In boring, time to drill 2000 mm. is taken as the basis for comparison of machinability. The effects of speed, feed, tool angle, etc., in these and several other types of machining are shown in curves for a few representative types of steels, ranging from low carbon steels to austenitic manganese steel.

In the discussion of machinability of free cutting steel a wide difference between rimmed and killed steel, in favor of the former is noted and curves are shown for a killed steel "according to a new method for improvement of machinability" which comes near to rimmed steel in machinability, but metallurgical information is not given on the composition and method. Suitable speeds, feeds, etc., are discussed for machining of cast and malleable iron, brass and bronze, aluminum alloys, and brief comment made on coolants and on methods of measuring machinability.

This is of some interest to metallurgists though not written from their point of view.—H. W. GILLETT.

SILVER: ITS PROPERTIES AND INDUSTRIAL USES. B. A. Rogers, I. C. Schoonover, and L. Jordan.

National Bureau of Standards, Circular C412, published by Government Printing Office, Washington, D. C., Oct. 2, 1936. 6 x 9 in., 52 pages, 32 figures. Price 10 cents.

In cooperation with producers of silver, a study of the metal was made with a view toward collecting the essential facts relating to its industrial uses. As in previous circulars dealing with various metals, such as aluminum, copper, nickel and zinc, this one summarizes the reliable data on physical and chemical properties of the pure metal, then discusses the important silver-rich alloy systems, including those with aluminum, cadmium, copper, lead, tin and zinc.

Under industrial uses, only the utilization of its bactericidal effect, of its corrosion resistance in chemical equipment, and of its conductivity and advantages as a switch contact in electrical apparatus are discussed.

The pamphlet is very concisely written and will take its place beside the former circulars as a primary source of information.—H. W. GILLETT.

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GMELINS HANDBUCH DER ANORGANISCHEN CHEMIE. PART A, SECTION 8. IRON. *(System-Nummer 59: Eisen)*

Edited by R. J. Meyer and E. Pietsch. This section by B. Grosse-Eggrebricht, A. Eisner and R. Sahmen.

Verlag chemie, g.m. B.H., Berlin, 1936. Paper, 7 x 10¼ in., 183 pages. Price 24.37 RM.

This completes Part A on the element and its alloys. Part B, on compounds, has already appeared and Parts C, D, E, and F dealing with mechanical, electrical, magnetic, and corrosion-resisting properties of steels, and analysis, and G, on cast iron, are in preparation.

This section deals with the physical (not mechanical) properties of pure Fe and FeC, with the systems of Fe and Fe + C with H, O, N, S, B, Si, P, As, Sb, Be and some complex combinations of these.

Copious references and the presentation of much of the data by curves increase the utility of the book.—H. W. GILLETT.

METALLURGY *(Métallurgie)*

53d EDITION. R. Cazaud.

Dunod, Paris, 1937. Artificial leather, 4x6 in., 424 pages. Price 20 francs.

This is one of a series of pocket-size handbooks, termed "Agenda Dunod." Topics covered run the gamut from blast furnaces to zirconium and the treatment varies from the inclusion of entirely obsolete electric furnaces, mentioned as though they were in present day use, to the inclusion of such modern alloys as Inconel and molybdenum high speed steel; from vague and meaningless statements such as that MoS is heated in a carbon tube by 900 amps. at 50 volts, to usable information on the rate of carburization of steel.

Information on standard French testing methods, or those apparently commonly used, is perhaps the most interesting part to the American metallurgist. The "hole-widening" test for deep drawing properties is mentioned. A curve for a stress-deflection test, alleged to be useful as a rapid endurance test, is shown in comparison with the S-N curve, but actually shows poor correlation. In sea water corrosion studies a solution of 300 g. salt, 1.896 g. sodium phosphate and 12.404 g. boric acid in 10 liters of water, pH 8.82, is suggested as a synthetic or substitute sea water.

The whole treatment is necessarily so sketchy in order to deal with ferrous and non-ferrous metallurgy in some 300 tiny pages that, in comparison with such metallurgical handbooks as those of Liddell, the A.S.M. etc., it is too incomplete to be of much value to the American metallurgist.—H. W. GILLETT.

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